INSIDE: UNDERGROUND RIVER SYSTEMS

Montana Outdoors

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JULY–AUGUST 2017

CAUTION: GRIZZLY AHEAD

Lessons from one hiker's encounter

IN THIS ISSUE:

THE OLD NORTH TRAIL

WOLVERINES, WHERE ARE YOU?

A WILD PLACE TO DISCOVER NATURE

WILL SMALLMOUTH TAKE OVER THE YELLOWSTONE?

Montana Fish, Wildlife & Parks

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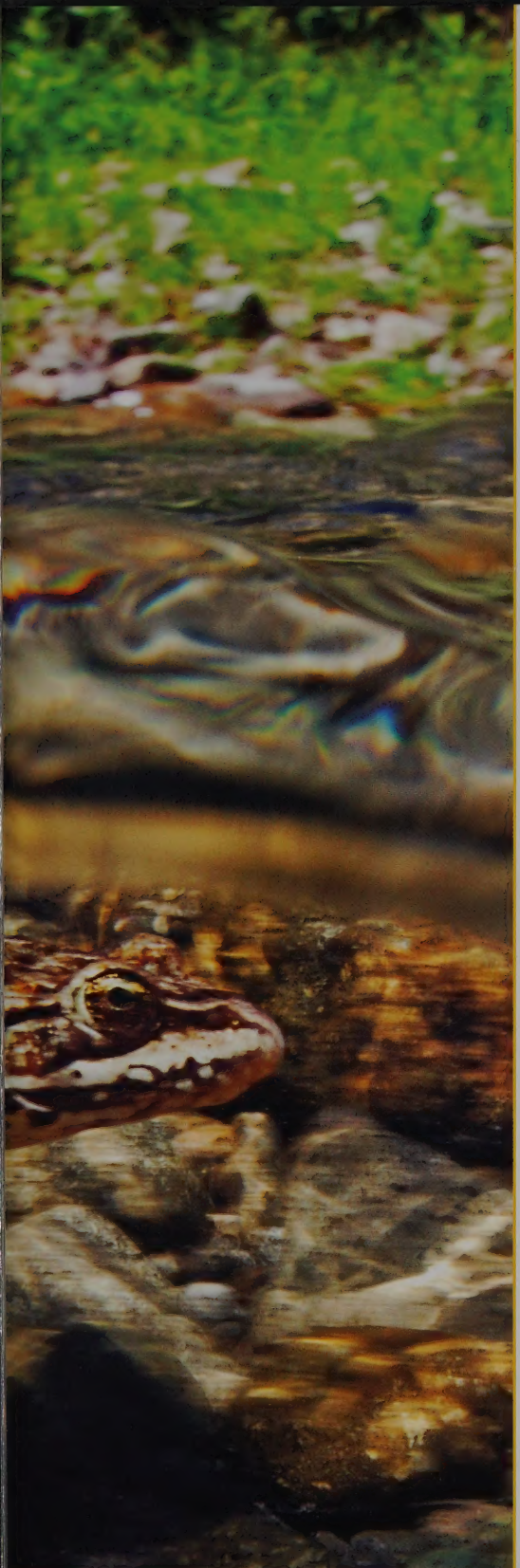

GROOVING THE GRAVEL
See page 32 to learn how underground river systems support species ranging from the Columbia spotted frog, shown here, to grizzly bears. Patrick Clayton/ Engbretson Underwater Photography

FRONT COVER
Turn to page 38 to learn what happened when a hiker found herself between a frightened grizzly bear cub and her angry mother. Photo by Jason Savage.

Montana Outdoors

JULY–AUGUST 2017

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Article kindles memories

Thank you for the story on the history of Montana fish management ("From Banning TNT to Scanning DNA," May-June). It brought back great memories. I have lived through many of those eras you describe, dating back to the 1940s when I first fished the Madison River as a boy with my dad and uncle, then into my 20s at Montana State College in Bozeman (now Montana State University). I remember being shocked at the idea of Fish and Game no longer stocking the Madison. But you were right: The fishing got better.

Merle T. Anderson
Great Falls

FROM Banning TNT TO Scanning DNA

What 100-plus years of fisheries management says about Montana and its people.

Next best thing

Thanks for another great issue of *Montana Outdoors*. I was glad to see that Medicine Rocks State Park was recently honored (Outdoors Report, May-June). My family and I picnicked at Medicine Rocks several years ago. Our children loved it. We love Montana, and getting *Montana Outdoors* regularly is the next best thing to being there.

Brian Aldrich
Winona, MN

Nonresidents and nongame wildlife funding

Regarding your call for nongame wildlife funding ideas (Letters, "What about nonresidents?" May-June). We fell in love with northwestern Montana a few years ago. We would gladly help fund nongame wildlife conservation through additional fees or taxes during our visits. We don't hunt, but we hike, mountain bike, fish, and do other outdoor activities, like rafting and taking hot air balloon rides. Montana could increase the bed tax on hotels, B and Bs, or other accommodations that visitors use.

Our home state of Florida imposes a tax split between the state and local municipalities. For example, these Florida counties impose the following: Dade 13%, Broward and Palm Beach 11%, and Orange/Disney 12.5%. I think the vast majority of Montana visitors are like us and would gladly pay an additional tax or fee if they knew it would help keep Montana wild. Thank you for sending us a small piece of Montana six times a year.

Allison LaBossiere, Jim Philpott
West Palm Beach, FL

Thank you for the amazing May-June issue of *Montana Outdoors*, which I read pretty much from cover to cover. On the letters page, you asked for suggestions for ways to raise money for nongame management. Here's one: The magazine, with its high-quality articles and photos, could command a higher subscription price. That extra money could perhaps provide additional funds for nongame fish and wildlife management. Maybe, for that higher price, you could include a special annual edition with additional Montana stories and photos.

I have lived in Bozeman since 1979 and need to accept that more and more people are coming to our state. I appreciate that you directly and indirectly emphasize the value of preserving the natural resources of Montana in the midst of a changing world.

Tryg Dahle
Bozeman

Father-son connection

My father's love for fly-fishing developed on the Bitterroot River in the early 1950s. He's now 85, and his mind is increasingly clouded by memory loss. Recently he moved to a higher level of care after releasing a can of bear spray in his room, then walking the grounds with his bow in hand. His older memories are the clearest: University of Montana (Class of '58, forestry); Montana's outdoors; the U.S. Forest Service; and raising us in Boulder, Anaconda, and Lewistown.

For years, Dad has sent me a gift subscription to *Montana Outdoors*. I've begun writing notes to him on the pages and mailing the issue back to him. I hope that every time he sees my notes he gets a chuckle or a fond memory, or that they remind him of how much I love him and appreciate what he taught me and the great times we spent together. Thank you for a great publication, and for the way the magazine helps me and my father share a connection.

Jeff Johnson
Texas Parks & Wildlife
Austin, TX

On their way

The letter in the March-April issue by the New York fan of Montana ("What's stopping you?") hit home with me as well. Living on the East Coast, and only being able to nibble on the many cultural, environmental, and social delicacies of Montana on our biannual family vacations is painful.

We fell in love with Montana in 2005, after my wife surprised me with a Christmas gift of a fishing trip to Big Sky. It took only five days for my heart to become permanently attached to the people, places, and beauty of my new "home," some 2,500 miles from where I live. Twelve years and thousands of dollars in vacation expenses later, hope is on the horizon. Our son has been accepted by the University of Montana, and I can retire from my job next year. We're on the eve of what we hope will land us in the place of our dreams. Through the years, *Montana Outdoors* has helped keep our hopes and dreams alive, as we study the pages of each edition. The pictures and articles have enabled us to take mental trips to places we've been, nature we love, and people we admire. For that, my family and I are so grateful.

Jack Tonkay
Dover, DE

Grilled Venison with Coffee Rub

By Tom Dickson | Preparation time: 10 minutes | Cooking time: 6 minutes | Serves 4

SHUTTERSTOCK

STEAK INGREDIENTS

4 1-lb. venison steaks or loin portions
2 T. tomato paste
1 T. kosher salt

COFFEE RUB INGREDIENTS

2 T. ancho chile powder
2 T. finely ground coffee
2 T. dark brown sugar
1 T. paprika
1½ t. dried oregano
1½ t. freshly ground black pepper
1½ t. ground coriander
1½ t. mustard powder
1 T. kosher salt
Vegetable oil spray

This past May, my friend Rob drove down from Calgary to visit me and my wife and fish the Missouri for a few days. I wanted to impress him with a great meal, so I fixed up a classic taste of summer: bruschetta served with grilled venison loin in a coffee–brown sugar rub.

Rob's eaten a lot of great venison over the years, but he said my grilled loin was some of the best he'd ever tasted. Much of the credit goes to the deer—a Meagher County whitetail doe fattened the previous summer and fall on alfalfa. But part was due to the rub.

Some venison purists turn their nose up at rubs, saying the meat is too delicious on its own to need enhancement. True enough, when you dine on venison occasionally. A loin steak cooked in a hot cast-iron skillet or over a grill, liberally seasoned with only salt and pepper, is near perfection. But if you're lucky enough to kill an elk or a couple of deer and a pronghorn, you'll plow through a lot of meat over the year. A rub lets you change things up and can turn a plain dinner into a special occasion for even the most discerning guests.

Rubs are mixtures of spices sprinkled or rubbed onto meat before cooking. Some commercial varieties available online and in stores work well, but most are loaded with salt, which is cheaper than the other ingredients. Rubs are easy enough to make yourself. I favor this one that mixes coffee, chile powder, and brown sugar, among other ingredients. It combines several recipes, including one from Mesa Grill in Las Vegas. The coffee provides earthy tones, the chile brings out the venison's natural sweetness, and the sugar caramelizes from the heat and helps form a light crust. Not everyone got a deer or elk last year. The rub works well with beef, too.

The tomato paste, slits, and spray-on oil are tips from *Cooks Illustrated* that help the rub adhere to the meat. The tomato paste also enhances the venison's meaty flavor.

—Tom Dickson is editor of Montana Outdoors.

DIRECTIONS

Prepare the grill. Pat steaks dry with a paper towel. With a sharp knife, cut shallow ⅛-inch-deep slits on both sides of the steaks, spaced ½-inch apart, in a crosshatch pattern. Combine tomato paste and 1 T. salt. Rub the salt-paste mixture into the slits.*

Mix remaining ingredients in a small bowl.

Coat one side of each steak with roughly 2 T. spice rub, pressing the mixture into the paste. Lightly spray with vegetable oil. Flip steaks and repeat.

Grill steaks until an instant-read thermometer inserted into the thickest part registers 120° for medium-rare, about 3 minutes per side. Transfer steaks to a cutting board and let rest for 10 minutes. Slice ½ inch thick. ■

*If you have time, create a richer flavor by letting the steaks rest at room temperature for 1 hour at this point.

Building partnerships and trust

Over the past five years, FWP has been trying to determine the size, range, and genetic health of the grizzly bear population in the Northern Continental Divide Ecosystem (NCDE). We're making great progress, but we could not have accomplished much without our essential partners: local ranchers and other landowners, the U.S. Geological Survey, U.S. Fish & Wildlife Service, U.S. Forest Service, Blackfeet Nation, Confederated Salish and Kootenai Tribes, Glacier National Park, and University of Montana.

In the Musselshell River Basin, we're seeing results from years of collaboration between FWP and farmers, ranchers, communities, water user associations, the Department of Natural Resources and Conservation, several federal agencies, five counties, and the Musselshell Watershed Coalition. Through these partnerships, new irrigation systems are being built, more water is making its way down the river, towns are receiving critical flood-remediation funding, and native fish are working their way upstream for the first time in decades.

We accomplish an enormous amount of work here at FWP. But we do so much more when working with others. As the department's new director, I'm making partnerships a top priority for this agency.

Partnerships produce results by bringing a wide range of individuals or groups together to share expertise and viewpoints. The most effective draw on different perspectives and skills that provide partners with an array of ideas and problem-solving tools. The tools help them tackle increasingly complex natural resources issues that require both traditional and new approaches.

Partnerships also build relationships. When FWP game wardens, biologists, and parks managers work with landowners, sportsmen's clubs, or communities, everyone involved begins to recognize their shared core values, and, in time, to trust each other.

Trust. That's something you can't earn with an e-mail or text message. When FWP employees and our partners work on specific projects together, we learn to rely on each other by laboring side by side to reach our goals. Shared sweat, toil, and problem solving strengthen relationships and increase mutual trust and respect.

No doubt, partnerships can be challenging. The more players involved, the more difficult it is to set up and run meetings, coordinate communication, and, especially, reach consensus.

But the alternative is less public support and, as a result, a less effective FWP. As Ron Aasheim, the head of the FWP Communications and Education Bureau who recently retired after an invaluable 42 years with the department, liked to say, "With public support, FWP can accomplish a lot. But without it, we can't do much at all."

That's because FWP is a public agency that serves the public's interests. Key to that is being open, inclusive, and helpful—to our traditional hunting and fishing stakeholders, of course, but also to anyone interested in fisheries, wildlife, or state parks conservation and management. By helpful I mean we always try to offer assistance when asked. Our default answer to any inquiry becomes, "Tell me more about your concern, and let's see if we can help." That doesn't mean we do things that compromise the department's core values or interfere with the work we need to do. But it does mean that even if we can't rescue orphaned fawns and baby birds, or post signs warning of every river boating hazard, we at least take time to explain the rationale behind our decisions.

Montanans want to know what we do and why we do it, and to participate in decisions that affect their recreation, livelihood, and communities.

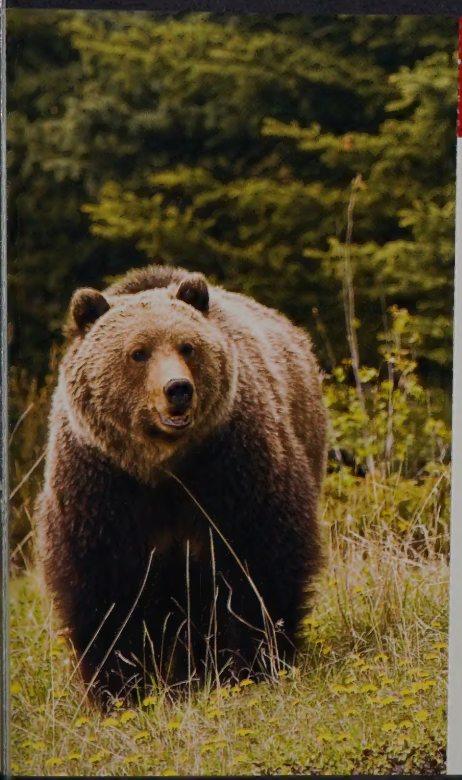
Building trusting relationships in the upper Big Hole River

Mountains, rivers, prairies, trout, elk, walleye, pheasants, grizzly bears, Makoshika State Park, Wild Horse Island—these are the essence of Montana and Montanans. As the public agency responsible for managing these and other resources, we are responsible also to the citizens of this state. Montanans look to FWP for stewardship and leadership. They want to know what we do and why we do it, and to participate in decisions that affect their recreation, livelihood, and communities.

Making that happen isn't just about FWP becoming more transparent and fair. As our employees working in the NCDE, along the Musselshell River, and elsewhere across Montana can attest, building partnerships is about making us an even stronger and more effective agency.

—**Martha Williams**, Director, Montana Fish, Wildlife & Parks

THOMAS LEE/MONTANA OUTDOORS



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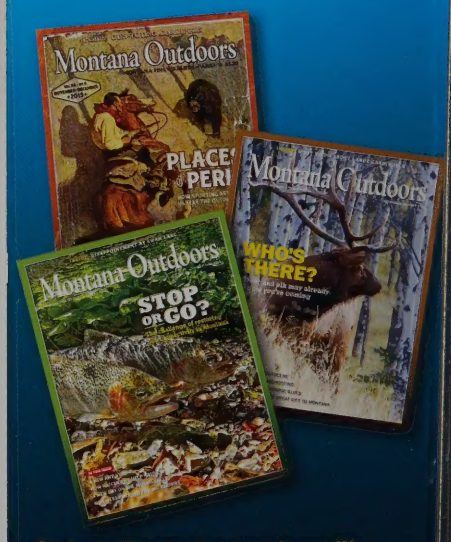

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THOM BRIDGE

VOLUNTEER WRANGLER

LAURA HAJEK
Administrative Support, FWP Regional Office, Great Falls

One of my many duties is to coordinate volunteers for our region. Each year that ends up being about 165 volunteers, who do everything from helping with kids' fishing clinics to driving shuttles for our wardens and fisheries crews when they work on rivers.

The biggest volunteer event of the year by far is the Montana State Fair, held in Great Falls each year for 10 days starting in late July. FWP is in charge of the Nature's Den building, and that alone requires about 50 helpers. The work starts in mid-July, when we get volunteers to help clean out the building and then lay live sod inside. Boy Scout volunteers bring in fragrant, fresh-cut ponderosa pines that we use to line the inside of the building. Volunteers also help us set up displays.

During the week and a half of the state fair, I've got pairs of volunteers working three-hour shifts staffing booths, handing out posters and brochures, and running kids' activities—like making animal tracks with ink and rubber stamps. When the fair ends, volunteers then help us take all the displays down, haul items back to the FWP office, and then clean up.

The volunteers—who include my parents, brothers, and even my grandmother, who works every single day at the Nature's Den—are fantastic. Most of them are retired, but we also have some as young as middle-schoolers. Everyone loves helping out. One fellow actually thanks me every time for letting him volunteer for FWP. It's really rewarding for me to work on something people enjoy so much that at the same time helps our department. It's definitely the best part of my job.

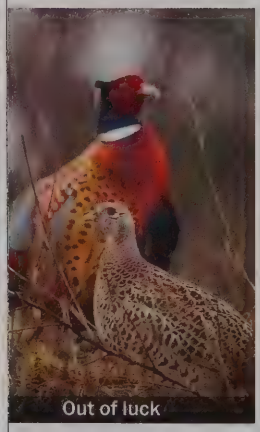
Photographer **JOHN WARNER** says he could "feel the electricity in the air" one hot July evening. He decided to drive north from his home in Billings and look for a photographic vantage point to capture the approaching thunderstorm. He ended up pulling off a gravel road about 10 miles north of town, where he set up his camera and tripod as bolts of lightning struck in the distance. "Because the lightning was so rapid and consistent, I thought of trying a four-frame panoramic, which would allow for a telephoto lens to compress the image," Warner says. "What you see here are four 30-second vertical frames, moving left to right across the landscape, thrown into Photoshop's Merge to Panoramic Program. I lit the sagebrush foreground with my flashlight to provide depth to the image. The amber glow in the distance comes from the ambient light of Billings. When one strike hit so close that it lit up the foreground and I felt the ground shake, I thought, 'Whoa, John, you're not being very smart right now, standing out here in the open holding a tripod,' and I quickly packed up and headed home."

7.1 Number of people in Montana per square mile (a population density lower only in Alaska and Wyoming)

Montana hit hardest by CRP declines

The federal Conservation Reserve Program has drastically shrunk in recent years. Created in 1986 to take highly erodible land out of crop production while boosting commodity prices, the program now enrolls fewer acres than any year since 1988. The biggest loser: Montana.

Montana has lost nearly 2 million acres of CRP grasslands since 2007. Contracts on another 400,000 CRP acres are set to expire this year.


Out of luck

"Folks with Pheasants Forever and the Mule Deer Foundation and Ducks Unlimited are already concerned," U.S. Senator Jon Tester told the *Great Falls Tribune* earlier this year.

North Dakota, Kansas, Texas, and other Great Plains states also have seen severe declines in CRP grasslands. Tester says the main reason is that the U.S. Department of Agriculture has shifted the program's focus to eastern and southern states, where landowners use CRP to protect and restore wetlands and riparian (streamside) habitat. "This puts large Great Plains states like Montana at a tremendous disadvantage." ■

STATE PARKS

Travelers' Rest preservation recognized

Travelers' Rest State Park is the only archaeologically documented campsite of the 1805-06 Corps of Discovery expedition.

The National Trust for Historic Preservation has included Montana's Travelers' Rest State Park on its recently released list of 11 historic sites saved from destruction. The designation came as the National Trust celebrates the 30th anniversary of its Most Endangered Historic Places list.

Over the past three decades, the organization has named nearly 300 significant historic sites at risk of destruction, raising awareness of America's architectural and cultural heritage and the threats they face. "Of the sites on the list since 1988, fewer than 5 percent have been lost," says David Brown, the National Trust's chief preservation officer.

This year's list highlights a diverse selection of 11 once-endangered historic sites successfully preserved thanks to the dedication and awareness of people who live and work in the surrounding communities, Brown says.

Other "saved" sites include Angel Island Immigration Station in San Francisco, Antietam National Battlefield Park in Maryland, and Nine-Mile Canyon in Utah.

Travelers' Rest, located ten miles south of Missoula, is the only archaeologically documented campsite of the Corps of Discovery along the Lewis and Clark Trail. The National Trust put the site on its most endangered list in 1999, sounding an alarm that convinced the Richard "King" Mellon Foundation, Conservation Fund, state of Montana, and National Trust itself to protect the area. They helped fund the purchase of a 15-acre site just west of Lolo that has since grown to 65 acres. In 2001, Travelers' Rest was designated as a state park. "When you look at other places on the list, it's humbling to be in such awesome company," says Loren Flynn, manager of Travelers' Rest State Park.

The park is managed by just two employees along with two dozen volunteers. Travelers' Rest drew a record 37,000 visitors last year, more than during the years of the Corps of Discovery bicentennial in 2004–2006.

Flynn says people visit the park to stand at a campsite in the footsteps of Lewis, Clark, and Sacajawea. "They also come out for an evening run, or to bird watch after work and on weekends," he adds.

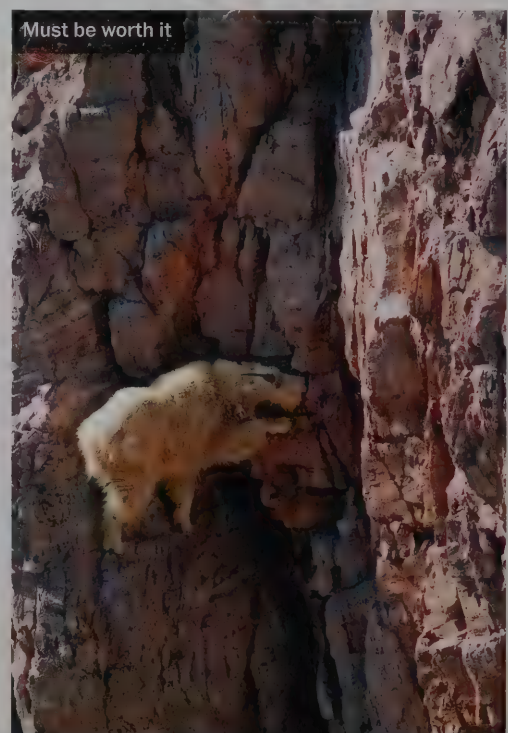
Flynn considers the new National Trust designation proof that grassroots preservation can work. "It's nice to be recognized, especially for all our volunteers and the people who were involved in protecting this site from the very beginning." ■

WILDLIFE WATCHING

See the licking goats

Glacier National Park visitors might want to make a brief detour if they travel U.S. Highway 2 along the park's southern border. Just off the highway is a "mineral lick" where mountain goats congregate along a steep mountainside above the Middle Fork of the Flathead River. The animals eat and lick the exposed soil, rich in calcium and other minerals.

The Walton Goat Lick is near Essex, 2.5 miles east of the Walton Ranger Station. A sign indicates a picnic area where visitors can pull off and park before walking a short path to an observation stand. Up to 30 goats typically congregate at the site in July. To protect the goats from traffic, in 1981 the Montana Department of Transportation and Glacier National Park built an underpass allowing wildlife to cross beneath the highway. ■


Must be worth it

CLOCKWISE FROM TOP LEFT: CARTOON ILLUSTRATION BY MIKE MORAN; MONTANA DEPT. OF TOURISM; MONTANA FWP; *MONTANA OUTDOORS*; NICOLE KEINTZ/SHUTTERSTOCK; LARRY STOLTE; TIM CHRISTIE

AQUATIC INVASIVE SPECIES

New rules for boaters and fees for anglers

This summer, all boaters in Montana must abide by new laws created by the 2017 Montana Legislature aimed at limiting and preventing the spread of aquatic invasive species. The legislation was spurred by the discovery last fall of invasive mussel larvae in water samples from Tiber and Canyon Ferry Reservoirs.

All watercraft coming into Montana from out of state, and all watercraft traveling across the Continental Divide into the Columbia River Basin, must be inspected before launching. Montana Fish, Wildlife & Parks has set up inspection stations across Montana. Watercraft owners must stop at any open station they encounter. Typically, these stops are brief and include a short series of questions about where the watercraft has been and a quick inspection.

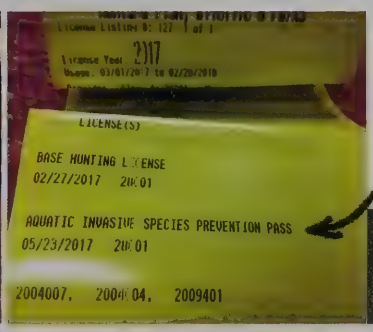
Also new this year are requirements that all watercraft leaving Tiber and Canyon Ferry Reservoirs must be decontaminated unless they have been certified by a local boater program.

Watercraft owners can speed up the inspection process and protect Montana waters if they consistently practice the Clean, Drain, and Dry protocols:

- Clean all debris from watercraft and trailer.
- Pull drain plugs and make sure all compartments, bilges, and ballasts are drained.
- Dry out watercraft, including livewells, storage areas, and compartments.

To help fund the inspections and decontamination work, all anglers must purchase an Aquatic Invasive Species Prevention Pass ($2 for residents and $15 for nonresidents).

The AIS Prevention Pass is available online at the FWP website and at all license providers. Anglers who have already purchased their fishing license—or a sportsman license, which includes fishing—will need to go online or to a license provider to purchase the new pass. ■



AIS check station and the new Prevention Pass required of all anglers.

CATCH A SAIL-FIN

Lost amid discussions about conserving fluvial (river) Arctic grayling in southwestern Montana is the fact that anglers can still fish for these beautiful salmonids in the Big Hole River.

Big Hole River release

The Big Hole is the only river in the Lower 48 with a healthy population of Arctic grayling. Fish for them as you do trout: dries and small nymphs for fly-anglers, and small size 0 Mepps or other spinners on 4-pound-test line for spin-fishermen. Bend down the barbs of your hooks to avoid injuring the fish, which must be released. The best fishing is from Jackson downstream to Wisdom. ■

Threatened by derailment

American Rivers: Middle Fork Flathead is endangered

The Washington, D.C.–based conservation group American Rivers recently included the Middle Fork of the Flathead River on its list of the 10 most endangered rivers in the United States.

Since 1984, American Rivers has made selections for its annual Top 10 list based on three criteria: The river is of regional or national significance to people and wildlife; the river and communities that depend on it are under significant threat, especially in light of a changing climate; and the river will face a major decision in the coming year that the public can help influence.

The Wild and Scenic Middle Fork of the Flathead River flows northwest from the heart of the Bob Marshall Wilderness along the southern border of Glacier National Park. The river is threatened by rail shipments of oil, benzene, chlorine, and other environmentally hazardous materials to ports on the Pacific Coast.

"A train derailment could permanently degrade the river and downstream waters, harming communities and the economy," says Scott Bosse, American Rivers' Northern Rockies Program director. The group is calling on the Federal Railroad Administration to develop "a safety compliance agreement with Burlington Northern Santa Fe Railway that would prevent derailments in this federally protected and critically sensitive Wild and Scenic River corridor." ■

Eyeing the New Neighbors

Smallmouth bass are moving upstream on the Yellowstone. Will they harm the river's renowned trout population?

By Jack Ballard

RED EYE FLIGHT Not native to Montana, the smallmouth bass has been moving increasingly farther upstream on the Yellowstone River. A likely reason: warming waters.

NATHAN COOPER

In the not-too-distant future, the classic Montana postcard could feature a fly angler on the Yellowstone River battling a leaping smallmouth bass rather than the classic airborne trout. That's the concern of some anglers worried that the non-native bass, slowly making its way upstream, may be displacing coldwater species.

"I wouldn't say anyone has panicked, but we definitely hear from some concerned trout anglers in the Livingston area," says Scott Opitz, Montana Fish, Wildlife & Parks biologist for the upper Yellowstone River.

For more than a decade, FWP biologists have documented temporary upstream migrations of adult smallmouth from the lower Yellowstone. But in the past few years, anglers and biologists have reported higher numbers well upstream of Billings. Mike Ruggles, an FWP fisheries biologist in Billings, says smallmouth have recently been caught by anglers in the Yellowstone as far upstream as the U.S. Highway 89 bridge at Livingston.

In many respects, smallmouth bass are similar to rainbow and brown trout, the two primary trout species occupying the Yellowstone above Billings. Smallmouth, like trout, thrive in clean streams and rivers. They also like cool water (50 to 70 degrees), though not as cold as what trout prefer (40 to 60 degrees). Like trout, young smallmouth eat insects but start to feed on crawfish, minnows, and even small trout as they grow.

Both species are highly regarded by anglers for their feisty fight when hooked. But much of Montana's angling tradition and valuable tourism industry centers on trout fishing, not bass fishing. As smallmouth move up the Yellowstone, local anglers, guides, and biologists are wondering what is prompting the migration, whether it's temporary or part of a long-term trend, and how the newcomers may affect the Yellowstone's renowned wild trout populations.

Jack Ballard is a veteran outdoors writer in Red Lodge.

STOCKED AT ANGLERS' REQUEST

The smallmouth bass is native to the eastern and central United States and southern Canada. Its range expanded in the late 19th century and throughout the 20th century as state and federal agencies, responding to angler requests, transported the hardy fish to rivers and reservoirs as far west as California. In various parts of the country, smallmouth bass are known as smallies and, for their coloration, bronzebacks, brown bass, and brownies.

The species first arrived in Montana in 1914 when the state stocked them in Horseshoe Lake near Bigfork. In subsequent decades, bronzebacks colonized other waters—most notably Fort Peck Reservoir and several lakes in northwestern Montana—sometimes stocked by state fisheries crews, other times spilling in from other waters.

Smallmouth first reached the Yellowstone via the Tongue River. The Montana Department of Fish and Game, as the agency was known then, stocked smallmouth in the lower Tongue from 1966 to 1969. Smallmouth also moved down from Tongue River Reservoir, into which they likely washed from ponds near Sheridan, Wyoming, during a year of high water.

Once in the Tongue, it was inevitable that smallmouth bass would eventually make their way downstream to the Yellowstone. Still more arrived from the lower Bighorn,

which FWP stocked during a few years in the late 1980s and early 1990s.

For the next three decades, smallmouth bass quietly populated a significant stretch of the lower Yellowstone. Mike Backes, FWP regional fisheries manager in Miles City, says a robust population now occupies the Yellowstone from Billings to the confluence with the Powder River. "Anglers catch them almost anywhere," he says. "They generally target the places they'd fish for trout: current seams and structure." In 2016, FWP raised the daily possession limit from five to ten—not to decrease the smallmouth population, Backes says, but because the tasty, white-fleshed fish were abundant enough to sustain a higher harvest level. Downstream of the Powder River, the Yellowstone becomes too murky for the sight-feeding predator fish to thrive. But in the clear waters upstream from Billings, the only thing holding back the bass has been colder water temperatures. Until recently.

For the past decade, the Yellowstone has seen lower water volume and elevated temperatures due to decreased mountain snowpack and several sultry summers. U.S. Geological Survey temperature monitors on the upper Yellowstone show a warming trend, says Optiz.

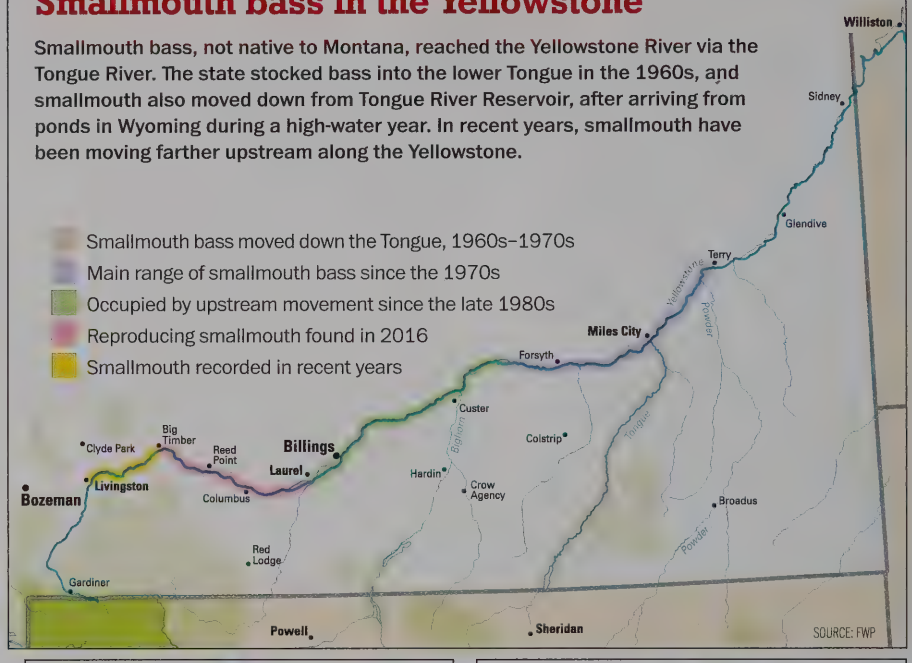
Whether that's what's drawing smallmouth farther west, though, is another matter. Ruggles says FWP can't state conclusively that warmer water accounts for the upstream movement of the more heat-tolerant species. "It seems likely, but it could be due to other factors we haven't yet identified," he says.

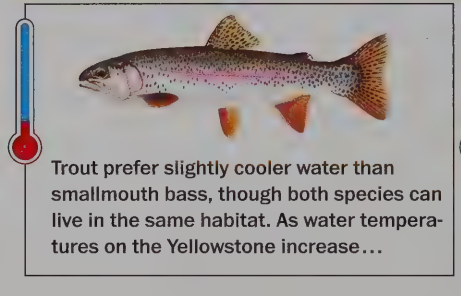
In a free-flowing river like the Yellowstone, temperatures typically increase downriver, as coldwater tributaries fed by mountain snowmelt give way to warmer prairie feeder streams. As water temperatures rise, habitat once hospitable to certain fish may instead prove more inviting to others. Upstream movement of a species like the smallmouth can be caused by slightly warming water temperatures that make those locations more favorable than in the past.

> "If we start to see a decline in trout numbers around Big Timber and higher, it will probably be due to warmer water, not the presence of bass."

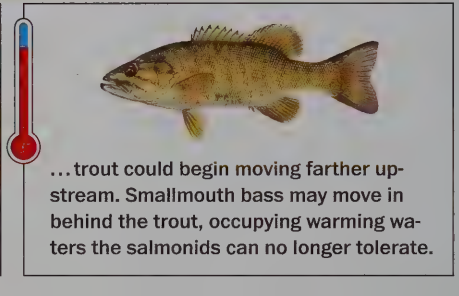
Smallmouth bass in the Yellowstone

Smallmouth bass, not native to Montana, reached the Yellowstone River via the Tongue River. The state stocked bass into the lower Tongue in the 1960s, and smallmouth also moved down from Tongue River Reservoir, after arriving from ponds in Wyoming during a high-water year. In recent years, smallmouth have been moving farther upstream along the Yellowstone.





Trout prefer slightly cooler water than smallmouth bass, though both species can live in the same habitat. As water temperatures on the Yellowstone increase…



…trout could begin moving farther upstream. Smallmouth bass may move in behind the trout, occupying warming waters the salmonids can no longer tolerate.

BECOMING RESIDENTS

Anglers with rod and reel and biologists using survey nets have captured smallmouth upstream of Billings for years. But those fish might have been on short-term journeys. Ruggles points out that bass can travel 100 or more miles in a river system to reach spawning areas, wintering pools, or ideal water temperatures. Such temporary movements don't make a species a permanent resident, however. To biologists, a species becomes resident to a portion of a river when it reproduces there.

As part of a cooperative study, U.S. Geological Survey (USGS) researchers, FWP biologists, and a Montana State University graduate student have been surveying the Yellowstone for smallmouth bass over the past several years. The scientists have been looking most closely for juvenile fish above Billings, indicators that bass are reproducing there. Adam Sepulveda, a USGS research zoologist, says that in the summer of 2016 survey crews found fingerling bass in backwaters as far upstream as the stretch between Reed Point and Big Timber, but none above there. That means smallmouth are now resident in the Yellowstone up to Big Timber.

Whether bass will maintain a successful foothold that far up the river remains to be seen. Research on smallmouth in other parts of the country indicates that if juveniles do not grow to slightly over three inches by the time water temperatures drop in the fall,

MAP ILLUSTRATION BY LUKE DUBAY/*MONTANA OUTDOORS*; FISH ILLUSTRATIONS BY JOSEPH TOMELLERI; SMALLMOUTH BASS PHOTO BY ERIC ENGBRETSON

they rarely survive winter. Along the Yellowstone, a string of colder-water years could severely limit bronzebacks from establishing residency farther upstream.

For the time being, the bass have established themselves in the lower reaches of Yellowstone's storied trout territory. One question now is whether the predatory fish will harm the river's rainbow, brown, or Yellowstone cutthroat trout populations. Ruggles says smallmouth bass could conceivably reduce trout numbers in two ways: by eating juvenile trout, and by competing with adult trout for minnows and other forage fish.

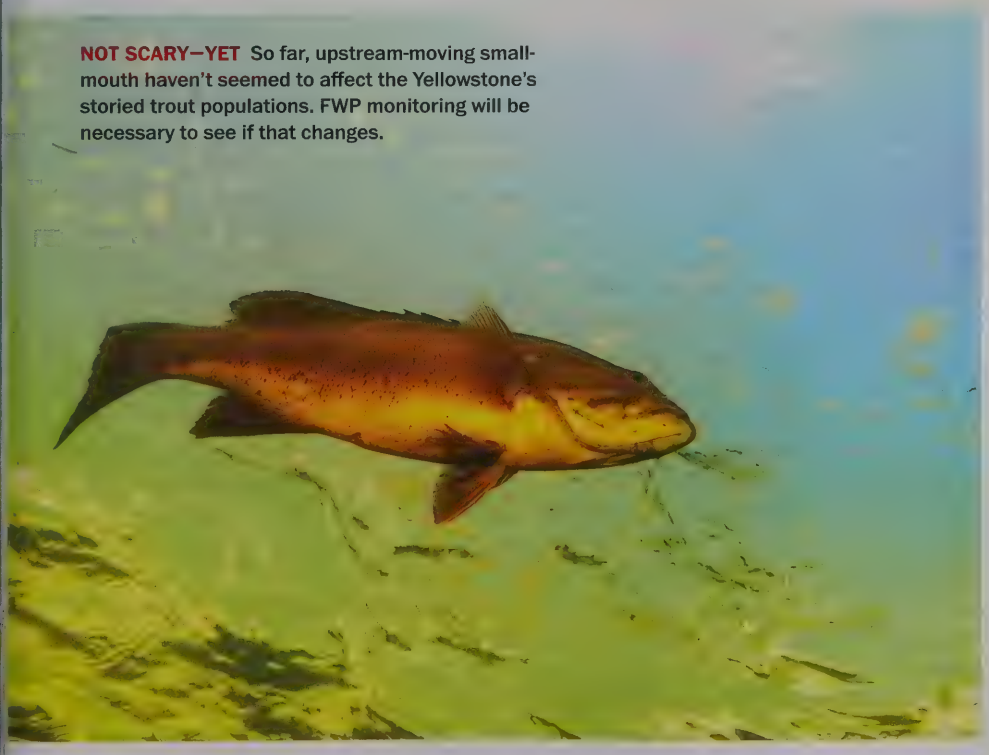
THE SKY: STILL IN PLACE

FWP surveys show that trout numbers in the areas where smallmouth bass now reside haven't declined. "The sky isn't falling," Ruggles says. That could be because other species that favor warmer water, such as sculpins and goldeye, also are moving upriver, perhaps providing additional prey for adult bass and large trout. The presence of these fish may also reduce the likelihood of smallies feeding on young trout. "Looking elsewhere in the United States, we've found that smallmouth coexist with all species found in the Yellowstone," Ruggles says. "We don't see smallmouth farther upstream as this big, scary development."

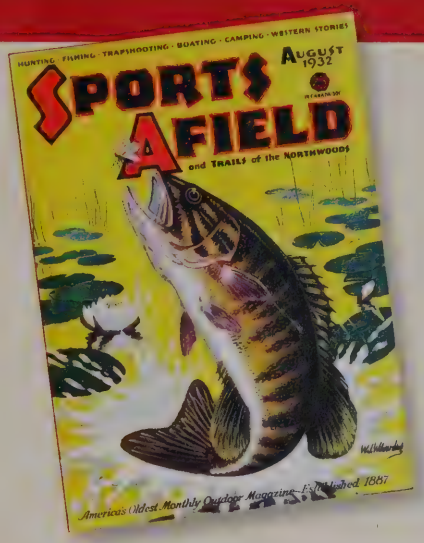
Yet that could change, which is why Optiz says scientists need to continue monitoring the Yellowstone. That includes measuring water temperature at more points along the river, investigating the relationship between bass and other species, and tracking bass and trout movements. "We need to determine the potential effects of smallmouth on trout," Optiz says. "Right now, it doesn't seem to be a problem. But could that change? And, if it does, is there anything we could do about it?

Eileen Ryce, chief of the FWP Fisheries Division, says that while the department will continue to monitor smallmouth movement in the Yellowstone River, trout anglers should be more concerned about warming waters. Temperature, not another fish species, would most likely push trout farther upstream.

So far, that hasn't happened. But if water temperatures continue to climb, trout may have to move into the Yellowstone River's cooler stretches around Livingston and then up into the Paradise Valley. "If we start to see a decline in trout numbers around Big Timber and higher, it will probably be due to warmer water, not the presence of bass," Ryce says.



NOT SCARY—YET So far, upstream-moving smallmouth haven't seemed to affect the Yellowstone's storied trout populations. FWP monitoring will be necessary to see if that changes.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SPORTS AFIELD
and TRAILS of the NORTHWOODS
AUGUST 1932
America's Oldest Monthly Outdoor Magazine

The "gamest fish that swims?"

The smallmouth's aggressive nature and acrobatic strength account for its popularity with anglers. When hooked, the bass often heads skyward, breaking the water surface and somersaulting in the air as it attempts to throw the hook. Early French explorers who came to North America called the newly discovered species "the fish that struggles." In a 1909 magazine story, Zane Grey wrote of his repeated but unsuccessful efforts as a young man to land what he called the "wolf-jawed, red-eyed bronzeback."

In addition to their feisty fight, smallmouth can be caught on a range of offerings. Fly anglers toss Dahlberg Divers and deer-hair poppers, while spin-fishermen use crayfish-imitating crankbaits and bait such as nightcrawlers. One Billings angler recently posted on her blog that she caught ten smallmouth in an hour "on some salad shrimp that I picked up at Albertson's." Smallmouth often strike surface lures and flies, which, because the angler sees the take, is one of angling's greatest thrills. Another bonus: Smallies are most aggressive during the hottest days of midsummer, a time when reservoir fish and river trout often refuse to bite.

In 1881, James A. Henshall, the leading authority on fish in his day, wrote of the smallmouth in his *Book of the Black Bass*, "I consider him, inch for inch and pound for pound, the gamest fish that swims." At the time, the term black bass encompassed both smallmouth and largemouth bass, making it unclear which species he was praising. For the millions of smallmouth fans across the United States, the inestimable ichthyologist was most certainly referring to their beloved bronzeback.

—Tom Dickson, Editor

UNAWARE Images of wolverines taken by trail cameras for a new multi-state study.

COUNTING GHOSTS

In the deep of winter, far into the backcountry, wildlife biologists search for the West's most elusive carnivore.

BY HAL HERRING. PHOTOS BY TONY BYNUM

U.S. Forest Service Bunkhouse
Augusta, Montana
December 12, 2016

Dawn is a long time coming, but the moon is huge and yellow, its light reflecting off the snow, and we barely need our headlamps. It's -17 Fahrenheit here in town, the snow around our boots as light as down. Nothing is done barehanded, not for long anyway.

Montana Fish, Wildlife & Parks field workers Wendy Cole and Daniel Madel hustle packs and toolboxes into the bed of the pickup, check the hitch on the snowmobile trailer, then load snowshoes and ski poles along with a deer ham and a couple of skinned beaver carcasses, the meat frozen hard as lead. In the windless crystalline air, the nostril-scorching stench of the liquid wolverine bait—an elixir of skunk glands, fermented beef blood, and a hint of potent urine stored in canisters in the truck bed—rises and falls as we work, then settles over us like a shroud. Madel, a stocky young man who will soon turn 30, shakes his head, grinning, "After every one of these trips, my fiancée makes me change clothes before I come into our house."

Cole pulls a strap tight on one of the packs, lost in thoughts of the day to come. Grinning, she asks Madel, "Do you think the people staying in the bunkhouse will care if we put all the beavers in there to thaw out?"

I'm on my first of two days accompanying the pair on a first-of-its-kind wolverine monitoring project. Over the next three months, these and other intrepid winter athletes will be setting up and checking 51 sites across western and central Montana. Two are west of my hometown of Augusta, near Crown Mountain at the far eastern edge of the Scapegoat Wilderness.

Cole is a tall, ultra-fit veteran wildlife technician originally from the mountains of Vermont, a skier and winter mountain traveler of the first order. Madel grew up in nearby Choteau, a hunter and a terror on the high-school wrestling mat. His father is Mike Madel, an FWP bear management specialist in this region, which is chock-full of grizzlies. Daniel has been following large carnivores through wild country since he could walk, and is steeped in the work and the tradition.

As Madel guns the truck through a berm of wind-drifted snow, Cole tells me they are

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Hal Herring of Augusta is a journalist and the conservation blog editor for Field & Stream.
Tony Bynum is an outdoor photographer in East Glacier.

working 10 sites this winter, scattered from here to St. Regis to the upper Yaak to the Cabinet Mountains. We drive west into the oceanic immensity of the prairie, a white arctic landscape stretching to our destination in the mountains, which stand jagged and moonlit to the color of tawny gold. As we get closer, we can see that the frigid stillness down here is giving way to something else way up high. From the heights of Crown Mountain a few plumes of snow are rising straight up, gathered and whirled by some wind cold beyond imagining. "There it is," Cole says from the back seat, wedged among down jackets, snowshoe bindings, bulky gloves, and snowmobile suits. She points to the ridge where the snow devils are rising. "That's exactly my idea of wolverine habitat."

And that's exactly where we're headed.

FROZEN FINGERS From top to bottom: FWP wildlife technicians Wendy Cole and Daniel Madel dig out a snowmobile trailer heading west to Crown Mountain from Augusta; chaining up; drilling holes into a beaver carcass so it can be wired to a tree.

Fearless ferocity

Most people reading this will know the basics of the wolverine, even if few of us—including backcountry-savvy winter travelers and hunters—have seen one in the flesh. Its scientific name is *Gulo gulo* (Latin for "glutton," tribute to the animal's supposedly insatiable appetite). It's the largest member of the weasel family, with an adult weight of 25 to 40 pounds. Wolverines are found in very small numbers throughout the world's northernmost regions, residing on a human-dominated planet only in unpeopled boreal forests, taiga, and tundra.

In the Lower 48, the roughly 300 wolverines—a rough estimate because the elusive, remote animals are so hard to count—are solitary inhabitants of the highest country, living amid alpine rocks, snowfields, and whitebark pine forests. There they hunt American pikas, marmots, snowshoe hares, red squirrels, and anything else that can be safely attacked and killed, including mule deer, elk, and even moose that get mired in deep snow. The animal is a super-carnivore, its powerful jaws, long claws, and fluid and aggressive athleticism coupled with a fearless ferocity that allows it to run a grizzly bear or wolf off a carcass and claim it for its own. The solitary males scent-mark and defend a territory of 300 square miles or more, where two or three females may live, each of which may raise two or three kits every other year in dens sheltered by snowpack or other dense cover. Unlike grizzly bears or other large carnivores, the wolverine was likely never a plains or lowland animal, even before European settlement. They've always preferred to live in the highest, roughest country.

> "There it is. That's exactly my idea of wolverine habitat."

Spurred to action

In 2013, the U.S. Fish & Wildlife Service (USFWS) proposed listing the wolverine as a federally threatened species, mainly because of the possibility that warming climate would someday reduce mountain snowpack, until recently considered necessary for winter denning (see "Wolverines, snow, and the ESA," page 18). This spurred the four states in the Lower 48 that have wolverine populations, along with tribal and university partners, to begin conservation work. "Our Western States Wolverine Conservation Program focuses on the same features that an ESA [Endangered Species Act] program would emphasize: monitor,

TRAIL CAM PHOTOS FROM MONTANA FWP.

INTO THE FOREST Top: Madel and Cole snowshoe into the Lewis and Clark National Forest to check on hair traps used to gather wolverine DNA. In many areas of the new study, researchers use snowmobiles to reach backcountry areas, but the vehicles aren't practical in some places. Below: Cole checks a trail camera for images of wolverines. Bottom: Madel prepares a beaver carcass to lure a wolverine into a tree where its fur can be captured.

connect, and restore," says Bob Inman, FWP Carnivore-Furbearer Program coordinator. The work by Cole and Madel is part of the monitoring component and is the first time the states have tried to document wolverine distribution and genetic profile across the Lower 48. Inman says the program aims at estimating occupancy, not actual population numbers, which would be prohibitively expensive. "By mapping where wolverines occur, then monitoring those sites over time, we can see if the range is contracting or expanding," he says.

Isolated populations of super-carnivores that are naturally uncommon, live only in high mountains, and have few young need proactive conservation work. Inman says that after biologists determine where in the four states wolverines live, they'll focus on determining what those populations need to survive and expand.

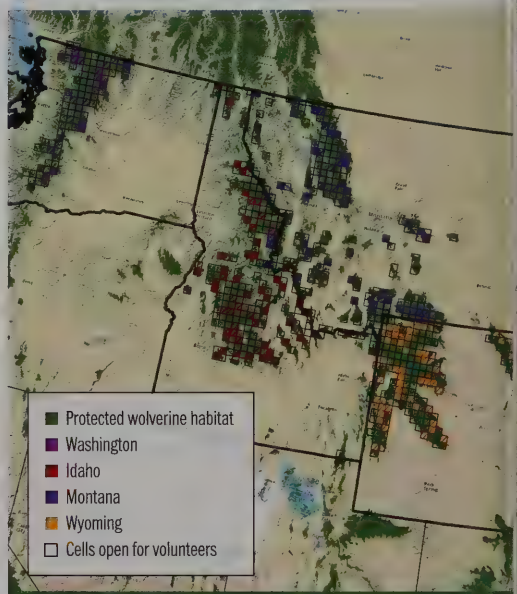
Funding for the work comes from the four states' conservation agencies (FWP alone has invested $100,000) along with the U.S Fish & Wildlife Service, U.S. Forest Service, National Fish and Wildlife Foundation, and Confederated Salish and Kootenai Tribes. "It's a collaborative effort, and we are all responsible for it," says Inman, who wrote his PhD dissertation on wolverines, directed wolverine conservation for the Wildlife Conservation Society, and published several scientific papers on the animal's biology, movement, and monitoring. "The primary responsibility to carry out the field work rests within each state's wildlife agency, and then all the partners will coordinate and share what we learn."

Before monitoring could begin, Inman and other carnivore biologists identified, based on existing knowledge, the best habitat across the four states that held or was likely to hold significant numbers of wolverines.

The next step came in the fall of 2016, when field crews across the four states set up hair traps, bait, and trail cameras in the likely habitat to start monitoring wolverine range. "We'll use this initial snapshot of population distribution to determine whether certain habitat features are good or bad for wolverines," Inman says. "It will also tell us if there are areas where introductions might work, and which areas are genetically connected."

Another project goal is to figure out how the habitats are connected. "We have these isolated high-elevation habitats, some of them in island mountain ranges, separated by sagebrush and rangelands," Inman says. "Because wolverines live in such low densities, the offspring have to leave their birthplaces for new territories, and they have to cross these low grounds to do that." The danger is that new development like roads and housing would block the animals'

Winter 2016-2017 wolverine study



LOOKING FOR *GULO GULO* The colors show locations of a total of 180 8-mile-by-8-mile cells in Montana, Wyoming, Idaho, and Washington where wildlife crews are checking for wolverine presence. After biologists figure out where wolverines exist, they'll focus on determining what those populations need to survive and expand.

movement. "That would leave the populations so separated that you'd eventually lose the genetic diversity that any species needs for long-term survival," Inman says. "So we need to figure out where those connectivity areas are and then make sure connectivity is conserved, by working with state and federal land management agencies and using conservation easements."

"Restoring populations there would go a long way toward ensuring the long-term survival of the species."

The third and final project goal is long term: Restore wolverines in places where they could and should be, but are not, either because they were killed off or for some other reason not yet understood. "For instance, we know they lived in Colorado and California until at least the early 1900s," Inman says. "Restoring populations there would go a long way toward ensuring the long-term survival of the species."

Though there have been no verified wolverine sightings around Montana's Crown Mountain in recent decades, Inman selected the area as some of the best potential habitat in the state. I love that notion. This is my family's hunting country in the fall and our hiking and wandering grounds in spring and summer. I can see Crown Mountain from my house on a clear day. That one of the wildest animals in the world might someday roam around up there makes the place seem even more wonderful.

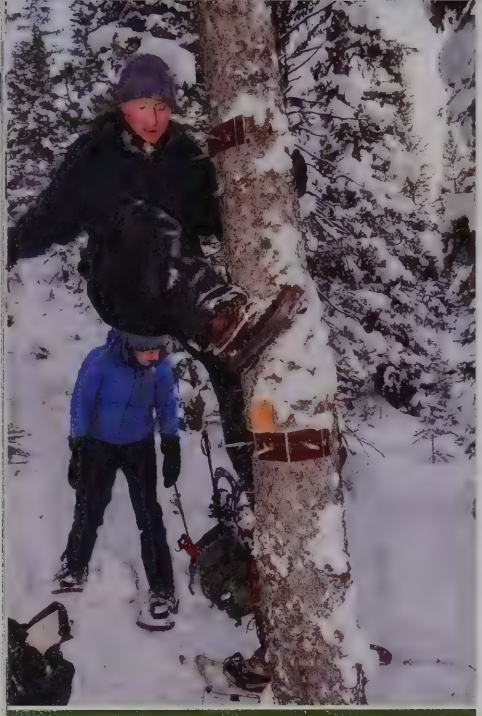
Unbearable stench

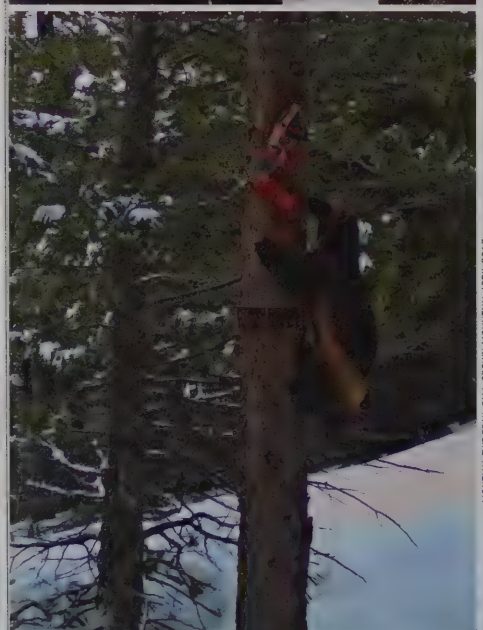
When Cole, Madel, and I arrive, far up the Benchmark Road, it is cold, but not as cold as in town. We leave the snowmobiles behind and proceed on snowshoes, threading the jackstraw deadfall—timber toppled after a fire burned through several years back—up through a mountain-shaded no man's land of thigh-deep powder, doghair Douglas fir, and lodgepole pine. Thankfully, we reach a ridgetop containing a wan bit of sunlight and more easily traverse areas where snow has been scoured away by wind. After an hour or so we get to the monitoring site, unshoulder packs, stomp snow to create a work space, and swap sweat-soaked inner layers for dry ones. I don't mention to the others that the lid on my thermos has come loose in my pack and the quart of hot tea and honey I was looking forward to is sloshing about, soaking my extra gloves, fire kit, and small stash of food.

The site consists of a bait station on a 10-inch-diameter Doug fir. A month earlier, Cole had fixed a deer hindquarter to the trunk with baling wire about 12 feet up. Above the hindquarter, another loop of wire holds a round yellow sponge saturated with the gland-blood-urine elixir so the wind could announce the bait site far and wide. At intervals around the tree trunk, stiff copper-bristled gun-cleaning brushes have been drilled into the bark. The bristles catch the hair—which provides DNA samples—of any creatures that climb to investigate the bait. About 20 feet away, a motion-activated trail camera is chained and locked 12 feet up another young fir. Today we are checking for hair and rebaiting the station.

Madel climbs the fir that holds the bait station. Cole pulls one of the frozen beavers from a pack, uncoiling lengths of baling wire that will fix it to the tree, and checks the batteries on the trail cameras. "It's always kind of a challenge when you first get here, because you've been powering your way uphill hauling the packs, and now, as you start to really chill down, you have to do all this fine motor-skill work," she says, not looking up. "These beavers are the best bait, because it's greasy, smelly meat wolverines supposedly

AT THE HAIR TRAP SITE From top to bottom: Madel pour a putrid mix of skunk glands, blood, and urine onto a sponge to attract wolverines to a tree from far away. Cole uses a lighter to sterilize wire brushes drilled into the tree that can catch hairs of wolverines as they climb to feed on the frozen beaver bait; upon arriving at the bait station, Madel waves his arms to test the trail camera in a tree overhead.





CUMBERSOME WORK From top to bottom: Using screw-in metal hooks devised by bow hunters to ascend trees, Madel struggles to climb a Douglas fir to attach the beaver carcass bait while maneuvering around wire brushes; at a secondary sampling station, Madel inserts a lure designed to attract lynx; trail cameras identify which wildlife species fed on the bait and the type of hair that scientists will likely find in the wire bristles.

really like. Also, they sit flat against the tree, so a wolverine can't get the torque to rip it off." Madel reaches the deer hindquarter—used in November because no beavers were available then. The haunch has been shredded to nothing but a fright-wig of sinews and a yellow-white femur.

> Budgets here are tight—nothing can be lost.

Cole scans through the images in the trail camera that she has retrieved. She's looking to see which animals visited the bait so she and Madel know whether any fur snagged in the wire brushes came from wolverines. All hair samples are sent to a laboratory for DNA analysis, from which biologists can identify the species, sex, and even an individual animal. Today, Cole announces that only gray jays have been working the meat. Barehanded, she quickly replaces the tiny SIM card in the camera, carefully stashes the old one in a file folder, and starts replacing the batteries. She and I then tie a frozen beaver carcass to a rope that Madel hauls up and wires to the tree before dousing the sponge with fresh scent, the juice dribbling down the trunk of the tree, potent and feral. A pair of wire snips falls and disappears deep into the snow, and Cole quickly digs them out. Budgets here are tight—nothing can be lost.

Nothing is easy either, in this frozen wilderness where high technology is paired with raw meat, fermented blood, and copper bristles to try and find a creature so elusive and ferociously wild that it has become legend. This project is sweat and muscle, frozen

Wolverines, snow, and the ESA

It's not like western states haven't wanted to learn more about their wolverines all along. The species has been increasing in number and range over the past century—showing up in recent years in California, Colorado, and even North Dakota, the latter for the first time in 100 years. Yet wolverines are still vulnerable due to their small population size in the Lower 48 and the isolated high-mountain habitats where they live. State biologists have long hoped to learn more about wolverines so they can conserve populations for the long term. "Unfortunately, we have limited financial resources, and because there were no indications that wolverines were in trouble, funding went to species with a clear, more immediate need," Bob Inman, FWP Carnivore-Furbearer Program coordinator, says.

State priorities began to change in 2013, when the USFWS proposed listing the wolverine as a threatened species. The proposal was based on a series of scientific papers that claimed the distribution of wolverines depends on deep snow for dens and can be determined by where snow cover exists on May 15. The papers' authors concluded that warming global temperatures would, in coming decades, shrink snow cover in late spring, a period they maintained was essential for wolverine denning.

> "The scientific process drove the decision, not politics."

But in 2014, after an independent panel of scientists reviewed the previous studies, the Service concluded there was far more uncertainty regarding potential effects of climate change on wolverines than previously thought. Since then, new research has showed that the initial snow analysis was flawed. "Researchers have now found that wolverines in Canada and Sweden are doing fine in areas where snow is long gone by May 15," says Inman. "That's because snow-

hands and balky snowmobiles, dead drill batteries, and avalanche hazards. Another threat is dehydration, because there's never time to melt snow to drink, and your water bottle froze 30 minutes after you left the truck. It is one tough species deeply engaged in studying another, looking for the best way to honor the whole tapestry of our lives here on this planet, in these last untrammeled spaces. I feel honored to be part of it, if only for this short visit.

Cole and Madel pack up and buckle on their snowshoes. They stand for a few seconds studying the bait station. "We had one of these beavers wired to a tree like this in the Bitterroots, with the wire around the spine. The wolverine ate the whole thing right in place, and then ripped off the backbone and left with it," Cole says.

We marvel at the thought, which is another constant in this line of work.

HAIR MAIL Wire brushes containing fur samples are later mailed to a laboratory for analysis. Scientists can determine the species, sex, and even the identity of individual animals that left the hair behind, information that wolverine managers will use to help conserve the species.

pack is actually most critical in mid-February, when wolverines are born in dens. And there will likely be little to no change in snowpack at that time of year."

According to Inman, who worked on wolverine conservation for the Wildlife Conservation Society before taking his current position, a widespread myth has taken hold that the Service altered its decision due to political pressure from the western states. "That's simply not true. The decision to withdraw the ruling was a direct result of a deliberate and required peer-review process of the scientific findings and additional review by the independent panel. The scientific process drove the decision, not politics," he says.

Nevertheless, the U.S. Seventh District Court of Appeals sided with environmental groups that sued the USFWS in 2014 over its decision to withdraw the listing proposal. The court ruling put the species back on the "proposed for listing" list.

The Service has said it will closely review all existing and new scientific data and issue a new ruling later in 2017.

In the meantime, Montana, Wyoming, Idaho, and Washington are forging ahead with comprehensive management of their own—developed in cooperation with the USFWS, National Park Service, U.S. Forest Service, and tribal and university partners—called the Western States Wolverine Conservation Project. "It's basically the same wolverine conservation program we'd have come up with if we had drawn up a recovery plan for wolverines if they were listed," Inman says.

—Tom Dickson, Editor

KERRY T. NICKOU

MAY SNOW: UNNECESSARY Some environmental groups claim that the U.S. Fish & Wildlife Service withdrew its proposal to list the wolverine after receiving political pressure from western states. Not so, according to state and federal biologists. They say the science-driven decision has been validated by new research in Canada and Sweden showing that May 15 snow cover does not limit wolverine distribution.

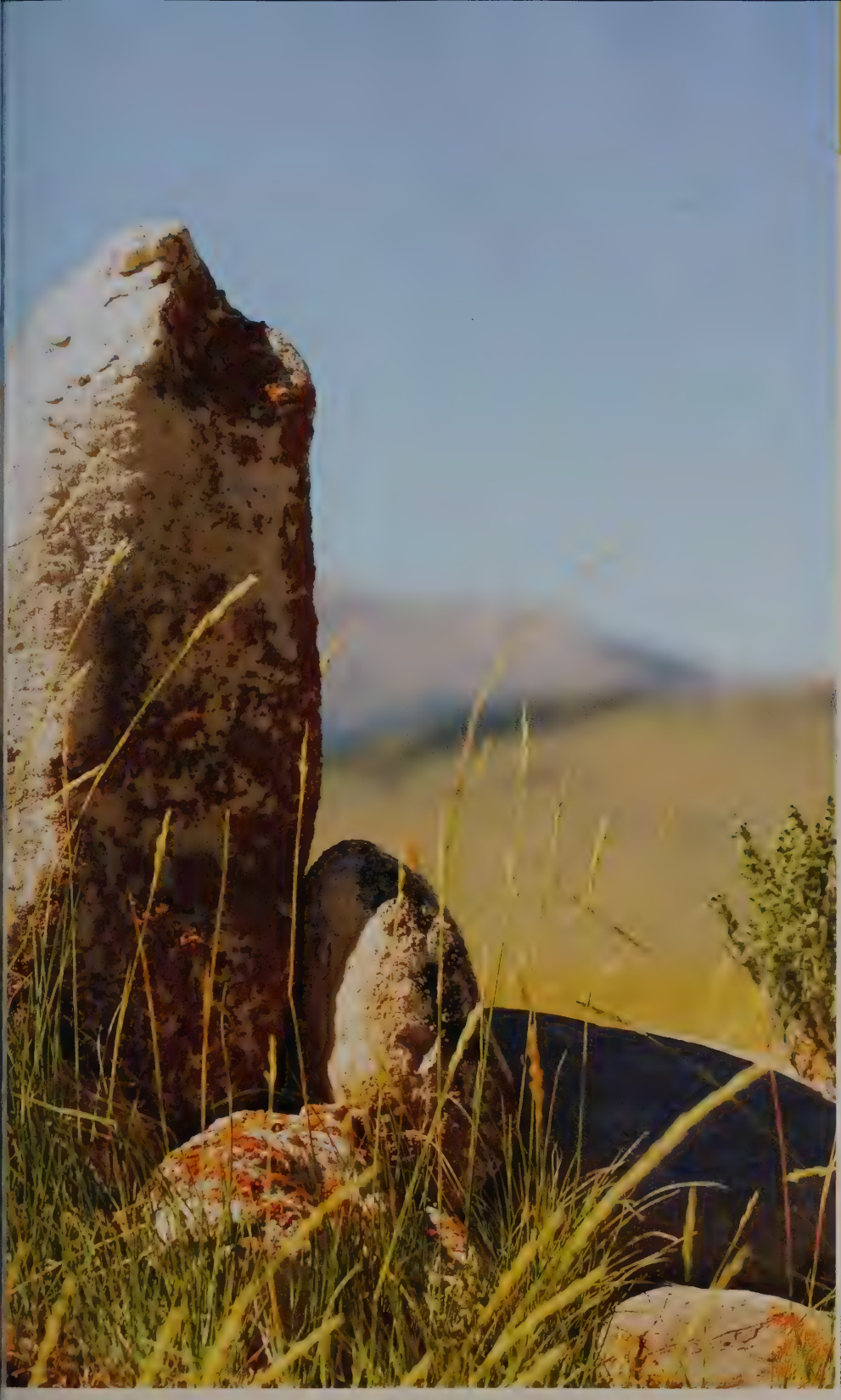
Continental Continuum

Searching for the origins of the Old North Trail along the Rocky Mountain Front

By David Cronenwett

A cold and quiet autumn morning settles into the canyon. As the sun finally climbs above thousand-foot limestone walls, shafts of October light begin to touch the forest understory. Overnight, frigid air from the surrounding mountains had pooled in the drainage, coating everything with a light frost. In this dense woodland of spruce and aspen sits a small, inconspicuous shelter. Joining with the chattering of chickadees and nuthatches are murmurs of human activity near a rough lean-to. A crouching figure clad in buckskin and wool digs through the remains of the previous night's fire. He soon finds a glowing coal in the ashes and transfers it to a nest of dry fibers, carefully blowing until the bundle bursts into flame.

Nearby, his companion chops dead timber with a hand-forged axe to feed the growing blaze, now thoroughly warming the shelter and its inhabitants. Water is quickly boiled, and the smell of mint-pine needle tea wafts up from the campsite. The men



JEREMIE HOLLMAN

A small boulder near Choteau, placed by local residents, indicates where travelers have been moving along the Rocky Mountain Front for thousands of years.

drink from cups carved of aspen wood and discuss the day of hunting ahead. They'd fashioned the camp using rudimentary tools with materials found entirely on the landscape: a raised duff bed and shelter, its poles lashed together with twisted willow; a tripod of sticks that held a pot over the fire. Fine shavings of curled wood litter the area near the hearth, evidence of hours spent patiently crafting objects useful for wilderness life. If a stranger bumped into this camp with its wool blankets, blackened pots, steel tools, and birchbark containers, they might think they'd gone back in time 200 years, when native peoples and fur trappers freely roamed the country. But no. The camp was the base from which my friend Kyle and I hunted last fall.

A few miles downstream, near the mouth of the canyon, sits a marker. After four days of living in the bush using the "old-school" methods described above, Kyle and I stop to inspect the small boulder just off the county road. As we approach, we can read "Old North Trail" etched on one side. I'd wanted to show Kyle this rock, placed in 1998 by local residents, a monument to an important travel route used by human beings for a long time. Roughly two dozen such boulders across Teton County approximately mark ancient ruts left in the ground by generations of people and their domesticated animals crossing this country. At our little primitive camp we'd lived, though briefly, in a manner similar to that of travelers who preceded us in previous centuries and even millennia, using simple and traditional gear, close to the land. The experience had a time-travel quality about it, one that fostered a tangible connection with the past.

Standing on what the Blackfeet call *Miisum Apatosiosoko* (the Ancient North Trail), where bare and moccasin-clad feet once walked, my friend and I had goose bumps, realizing that our presence there along the Rocky Mountain Front made us part of a continuum of hunters and travelers stretching back to the very origins of the continent's ancient human history.

"A well-known trail"

Beginning roughly 1,500 years ago at the start of the Late Prehistoric period, this trail was one of the most significant of many that crisscrossed the mountains and plains of today's Montana and beyond, part of what constituted a vast trade network among far-flung tribal peoples. "Lewis and Clark specifically mention the frequent presence of 'Indian roads' in their journals, which coincides with our understanding of well-established travel and trade routes across the region," says Sara Scott, State Parks Heritage Resources Program manager for Montana Fish, Wildlife & Parks. Diverse artifacts like Northwest coast harpoon tips and coiled basketry from the Southwest found near routes in Montana indicate just how far trade items traveled.

The Old North Trail runs along a north-

south axis. It follows the east flank of the Rockies between Alaska and the heart of the continent as far south as Mexico. Standing on the trail, it's easy to imagine bands of Blackfeet and other tribal groups with their dogs and, after about 1700, horses hauling travois loaded with possessions over the rolling foothills to visit family or move camp to a new buffalo jump. In the early 1900s, young ethnographer Walter McClintock, working for the fledgling U.S. Forest Service at the Blackfeet Reservation, quoted a Blackfeet man, Brings-Down-the-Sun, about the route: "There is a well-known trail we call the Old North Trail. It runs north and south along the Rocky Mountains. No one knows how long it has been used by the Indians."

To be clear: The "trail" is not and never has been a maintained single-track path like what you'd find in a national forest. Prehistoric routes like this are travel corridors, up to several miles wide, with bare spots in areas of concentrated use. These routes often braided out and sometimes disappeared altogether with changes in topography. Travel was slow in those days of foot and dog and horse, making the world a great deal bigger. Evidence of that tread has been lost to erosion and development, but abundant cultural sites remain that help define the travel corridor. Tipi rings, buffalo jumps, drive lines, rock cairns, pictographs, and ancient campsites littered with stone tools remain along the corridor in Alberta, Montana, and beyond, evidence of thousands of years of use. "Nobody has done a landscape-scale study of this particular trail," Scott says, "but the linear flow of sites indicates a clear north-south trending route."

WHICH WAY? The Old North Trail follows the Rocky Mountain Front in both directions. Original use may have been from generations of travelers moving from today's Canada after crossing Beringia from Siberia. A newer theory suggests that the first users came from the south, having reached southern parts of the Americas traveling by boat along the Pacific Coast.

Into Montana from the south?

Though the heyday of the Old North Trail and its heaviest use seems to have been during the Late Prehistoric period (A.D. 500–1750) there is no question that people used it for thousands of years before that. The deep history of the trail relates to the history of mankind in North America.

For decades, scholars theorized that the first people on this continent arrived here via a long-vanished land bridge—known as Beringia—linking Siberia and Alaska over the Bering Strait, then followed a nearly 1,000-mile-long ice-free corridor that emerged east of the Rocky Mountains in present-day Canada and continued south into the United States.

But recently, some scientists speculate that no person could have survived along the corridor until 12,600 years ago. They maintain that most of Canada was still covered in ice and without vegetation or wildlife. Yet carbon dating at archaeological sites shows that people were living on this continent, south of the glaciers, at least 13,000 years ago. If, as they believe, these early North Americans couldn't have used a land route from Alaska, how did they get here?

One new theory suggests that early Paleo-Indians, after reaching Alaska from Siberia, boated down the Pacific coast, an environment rich in food and materials for boat building and shelter. Some eventually made it as far south as southern Chile in South America, as indicated by recent archaeological finds. An argument in favor of this theory is that maritime technologies have been employed by people for millennia. Australia, for example, was colonized by boat around 60,000 years ago. What's more, the Pacific Ocean was nearly 400 feet lower at the time of the North American migrations, because enormous amounts of Earth's water were still frozen in polar ice sheets. That exposed more nearshore islands and coastal landforms than we see today, making coastal travel safer and easier. At some point, the pioneers

CLOCKWISE FROM ABOVE LEFT: LUKE DURAN/*MONTANA OUTDOORS*; JEMIE HOLLMAN; JOHN LAMBING

Writer David Cronenwett lives in Helena.

SMART ROUTE Above: Travelers may have selected the corridor along the Front because it provided abundant prairie game and a steady water source from streams flowing from the mountains. A north-south route farther to the east would have meant difficult river crossings. Below left: Tipi rings, along with buffalo jumps and rock cairns along the corridor in Alberta and Montana, provide evidence that people have used the Old North Trail for thousands of years. Old-timers along the Front say the route was still being used as recently as the 1950s by people traveling by wagon between Montana and Alberta.

moved inland, perhaps up the Columbia River drainage, and began to explore the continent's vast interior, possibly 15,000 years or more ago.

Tenuous existence

The first bands to arrive in what became Montana were highly mobile hunter-gatherers traveling on foot in small groups. Though that world was empty of all other people, it was by no means vacant. Massive predators and large, dangerous herbivores roamed the landscape. Trails were created by roaming mammoths, mastodons, and several species of bison, as well as the monstrous predators that followed across the cold, shrub-steppe environment: American lions that may have hunted in large prides, three species of saber-tooth cat, dire wolves that weighed up to 150 pounds, and massive short-faced bears that stood up to 12 feet tall and weighed a ton. These creatures hunted humans and often showed up when people butchered a kill. The earliest Americans lived a tenuous existence, relying completely on stone and bone tools to make everything they needed to survive.

In addition to traveling along rivers and other natural corridors, those early North Americans likely followed seasonal migrations of game, wherever that might lead. There were no human-established trails, no trade routes, and certainly no "Old North Trail." Then, around 13,400 years ago, the climate warmed and began rapidly thawing the great glaciers to the north. A gap eventually emerged in the ice sheets, and wildlife and people began to enter it—from the south. Once the corridor was fully free of glacial ice, movement could occur in both directions, and the landscape slowly became an active travel corridor. Such may have been the fragile beginnings of the Old North Trail.

This new version of the corridor's origins is perhaps less evocative than the more established one—which implies that by visiting the Old North Trail you might walk in the footsteps of the first people who entered today's United States from the north. But what the revised theory lacks in drama, it makes up for in mystery: Where did those first people who walked north along the corridor come from? Had they journeyed east from the Columbia River Basin, crossing the Rocky Mountain Front at Rogers Pass, south of Augusta? Were they working their way north from today's Central America and Mexico, eventually reaching Alaska, from where their forebears first began coastal journeys south hundreds of years before?

Few of the stories that occurred along the Old North Trail will ever be told. But the overall tale of the corridor is known, and it is one of the human family and its survival. From its earliest use during the Pleistocene to the rise of the buffalo hunting cultures to the present, the Old North Trail was not only a physical pathway, but a vast cultural corridor. It is our generation's task to keep the idea of the trail alive through study, education, and conservation, and to protect one of the world's greatest cultural treasures—a big piece of which sits right here in Montana.

Granite boulders marking portions of the Old North Trail were placed by local historian Al Wiseman, of Choteau, and several friends. Most are on private property. Three can be seen from public roads, with some searching and effort. Inquire about directions to the markers at the Old Trail Museum in Choteau (406-466-5332) and Two Medicine Dinosaur Center (406-469-2211), both open from Memorial Day through Labor Day.

CENTER STAGE Surrounded by wildlife mounts in the Montana WILD education facility, FWP Angler Education Program coordinator Dave Hagengruber explains to Billings-area fourth-graders the difference between native and non-native fish species. Students travel to Montana WILD from throughout the state to learn about fish, wildlife, and state parks, and how FWP and citizens work together to conserve these resources for the good of Montana.

From Abstraction To Reality

At FWP's **Montana WILD** education facility, kids and adults discover, appreciate, and take pride in the natural surroundings where they live.

By **Tom Dickson**
Photos by **Thom Bridge**

EYE OPENER "A lot of these kids have never been outside of Billings before," says one teacher. "Coming here lets them see what Montana is all about."

On a breezy Wednesday morning in May, two chartered buses pull into the Montana WILD parking lot in Helena, open their doors, and disgorge 67 fourth-graders from Big Sky Elementary School in Billings. When the kids enter the education facility, they don't know where to look. The bright, high-ceilinged building is filled with dozens of wildlife mounts.

A mountain lion prowls a rock archway. Two mule deer bucks run across a prairie. A mother black bear stands below a tree where her cub has climbed. While a herd of bighorn sheep graze nearby, a pronghorn crawls under a fence. Museum-quality aquariums designed to look like real rivers contain live trout, walleye, bass, suckers, and other fish. Kids are encouraged to touch and handle most items on display.

As their teachers check in with Ryan Schmaltz, who runs the front desk and helps with education programs, the children race about looking at exhibits. One wide-eyed boy stops and stares at a full-size grizzly bear and her two cubs, saying to no one in particular, "This place is awesome."

Montana WILD is no ordinary science classroom. The building is a restored limestone foundry built in 1892, now staffed by Montana Fish, Wildlife & Parks education specialists who run science and conservation education programs. Throughout the school year, students from across the state visit the center to learn about Montana mammals, fish, reptiles, and ecosystems, along with fisheries and wildlife management and the role of citizens in conservation. During free evening programs, instructors teach kids and adults about fly-fishing, kayaking, archery, raptors, and more. Several times each summer, volunteer bat experts lead twilight tours, showing participants how to use ultrasound equipment to identify the species of winged mammals flitting overhead.

By tailoring programs to where people live, Montana WILD sends visitors home with a new appreciation of their local environments. "What we ultimately aim for here is more than just learning," says Thomas Baumeister, chief of the FWP Conservation Education Bureau. "We want to see an awakening, where youth and adults who come here understand and then value their own environment and feel excited and proud about their wild neighbors—the deer, the

Tom Dickson is editor of Montana Outdoors.
Thom Bridge is a photographer in Helena.

ALL EARS Ryan Schmaltz explains the day's activities to students. A South Dakota game warden before moving to Montana, Schmaltz says he enjoys the kids' enthusiasm and attention. "At this age, they listen to everything you say about wildlife and fish."

antelope, the trout, the raptors—that make Montana the special place we love."

BUSY DAY

Schmaltz divides the Billings students into three groups and explains the day's activities: a scavenger hunt in the main exhibit hall, a science field investigation and bird survey at adjacent Spring Meadow Lake State Park, and a bear awareness program in the facility's auditorium.

Friends Zoe and Gracie team up for the scavenger hunt. Rushing from one exhibit to the next, they count the teeth in a deer skull (32), measure the tail of a mountain lion pelt (31 inches), learn how many cutworm moth larvae a grizzly bear consumes in a day (about 40,000), weigh bighorn sheep horns and elk antlers (24 and 26 pounds, respectively), and learn what a lynx likes to eat (snowshoe hares). Zoe studies a display on ospreys and tries to figure out why discarded baling twine is bad for the raptors. "I think they might get tangled up and die," she says.

Julie Dawkins, one of three teachers accompanying the group, marvels at the buzz of activity. "A lot of these kids have never been outside of Billings before," she says. "Coming here lets them see what's in Montana, what this state is all about."

At the aquariums, a dozen students who had been studying fish identification as part of the scavenger hunt surround aquatic education specialist Dave Hagengruber.

"How do you tell a cutthroat from a rainbow?" he asks.

"The cutthroat has a 'cut' throat," shouts one boy, referring to the orange slash below the fish's lower jaw.

"Right. How do you identify a catfish, using the right term?"

"By the *barbels*," one girl quickly answers.

Outside, two dozen students follow a path to Spring Meadow Lake. Kurt Cunningham, a veteran FWP educator, leads them near the shoreline. "These are water-loving shrubs," he says, pointing to a stand of willows. "Does anyone know what *kind* of shrubs they are?"

"*Water-loving* shrubs!" the kids cry out in unison.

These are fourth-graders, after all.

Cunningham takes the students to the water's edge. A red-winged blackbird scolds from a nearby cattail marsh, while tree swallows swoop over the lake surface. A double-breasted cormorant dives then surfaces with a small trout in its bill, swallowing the fish in one gulp. "Cool!" the kids shout out. Cunningham points to a robin's nest in a cottonwood, the mother's tail peeking out from the small basket of woven twigs. "She's sitting on her eggs," he whispers. "The chicks will probably hatch in a few days." The children scribble in their notepads in preparation for a quiz back inside.

For older students, lessons at Montana WILD are more complex. Working in teams, some hone math skills to determine how many fish live in a river. Others devise ways to reduce conflicts between mountain lions and people. Students learn how fisheries and wildlife biologists use math (modeling elk populations), science (analyzing DNA to survey fisheries), and technology (tracking wolverines with GPS radio collars).

Students also hear conservation success stories. "We show them how regular people are out doing things to restore and preserve Montana, like conserving grasslands with rotational grazing or planting native prairie plants," says Education Section supervisor Laurie Wolf. "Then we have them actually do things for conservation, like decorate plastic markers that prevent sage-grouse from flying into barbed-wire fences."

RESTORATION From left to right: The Montana WILD site in Helena originally contained a sand and gravel pit and the Stedman Foundry and Machine Company. The renovated building is now a learning center.

AWARE OF BEARS Students answer questions posed by Laurie Wolf, Education Section supervisor, during a presentation on grizzlies. Her talk includes information on safety in bear country, the importance of protecting habitat, and the role of hunters in funding management work.

CRAVING INFORMATION

Evening adult and family events can be standing room only, like several this past winter on grizzly bear awareness and bear spray training that attracted dozens of mountain bikers, anglers, hunters, hikers, trail runners, and others. Like so many Montana WILD sessions, the bear programs were led by volunteers, in this case Bill and Marti Cook of Helena, who've been volunteering at the education center for five years. "Our volunteers are just amazing," says Wolf. "We couldn't provide this service without them."

Upstairs in the Montana WILD offices, FWP staff coordinate statewide educational programs such as Hooked on Fishing, which teaches students about Montana's rivers, lakes, fish, and other aquatic life. Wayde Cooperider and assistant Sara Smith run the Hunter and Bowhunter Education Programs, through which 1,500 volunteer instructors across Montana teach youth and adult hunters the basics of firearms and bowhunting safety, hunting ethics, and game animal identification. Becoming an Outdoors-Woman, coordinated by longtime FWP educator Liz Lodman, provides opportunities for adult women to learn outdoor skills such as fishing, shooting, archery, and kayaking while building confidence in the outdoors.

In a typical year, Montana WILD sees 3,500 to 4,000 school kids, bused in from across the state thanks to special funding from the Montana Legislature. Roughly 1,000 kids from youth groups visit, too, along with 2,000 to 3,000 children and adults who participate in programs at the site, and another 3,500 who attend off-site programs. "This really has become the epicenter for learning about wildlife and the outdoors in Montana," Baumeister says.

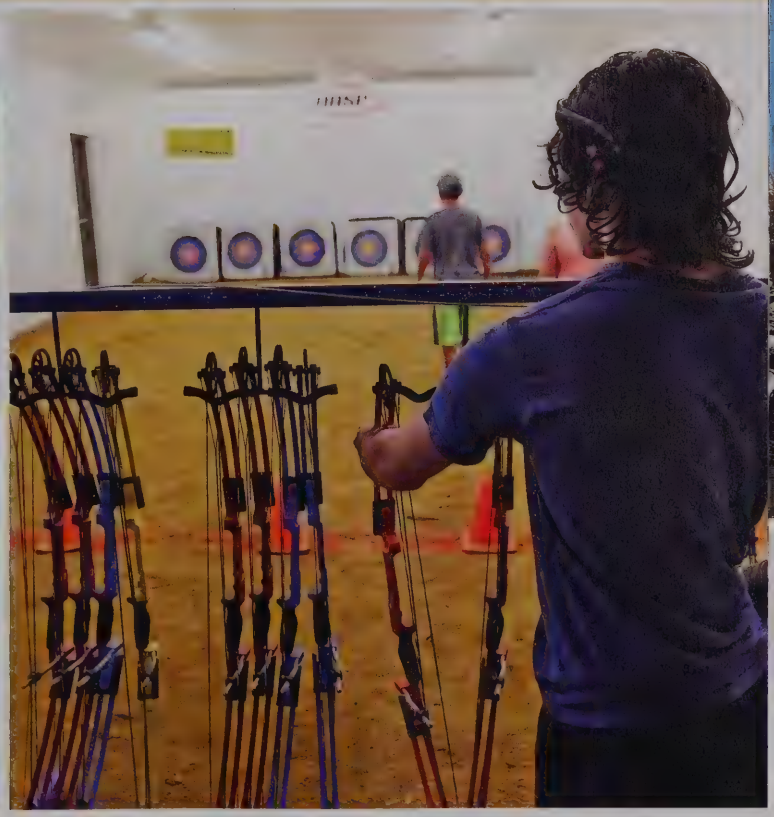
MONTANA WILD
MONTANA FISH, WILDLIFE & PARKS

For information on youth and family programs, hours, and dates, visit **fwp.mt.gov/education/montanaWild** or call **(406) 444-9944.**

By now, the students in the building have crowded around Lisa Rhodin, who carries a great horned owl on her leather-gloved wrist. The raptor, whose wing is irreparably damaged, is an "ambassador bird" from the FWP Wildlife Rehabilitation Center next door, which Rhodin supervises. Rhodin, local veterinarians, and other devoted volunteers treat and release, back into the wild when possible, wounded birds of prey and orphaned black bears.

The kids stand transfixed as Rhodin explains how the bird's talons work for killing prey and its head shape and ear position allow it to hear mice scurrying under snow. "What you see here is the process of making connections," Baumeister says. "In a school classroom, kids may learn about owls, but here we make that concept real and relevant. They see a live great horned owl up close. They learn that these birds live all over Montana, probably near where they live. Suddenly, you see it in their eyes. They're thinking about when they go home and how they will be out looking for owls. That's how you get a

ACTION-PACKED PLACE Top: Several times each summer, Helenan Matt Bell and other bat experts lead twilight tours and show participants how to use ultrasound devices to identify the species of winged mammals flying overhead. Bottom left: Becoming an OutdoorsWoman coordinator Liz Lodman says the education program builds confidence in the outdoors for participants, many of whom learn to cast a fly rod, fire a gun, and set up a tent for the first time in their lives. Bottom right: Montana WILD includes a 50-foot range where kids and adults learn about and practice archery.



SEEING FOR THEMSELVES Youth Education Program manager Kurt Cunningham shows fourth-graders a robin's nest. "She's sitting on her eggs," he whispers. "The chicks will probably hatch in a few days." Experiences like these can motivate kids to learn more about the outdoors.

young person engaged with wildlife and plant the seed for wildlife conservation."

THE KIDS GET IT

You'd think nine- and ten-year-olds would be bored by a one-hour PowerPoint presentation. But in the darkened Montana WILD auditorium, students watch intently as Laurie Wolf shows photos of black bears and grizzlies while explaining how to tell the species apart. "Grizzlies have a muscular hump on their back, longer claws, and round ears," she explains. "Don't use color to try to identify bears, because many black bears can be cinnamon or even brown." She moves through slides of the grizzly's historical range and explains how habitat loss and poaching led to the species' decline. Then Wolf raises a question that even many adults can't answer correctly.

"Where do we get the money to conserve grizzly bears, along with black bears, mountain lions, elk, and other wildlife?"

The kids don't know. She waits a few more seconds. Then one boy raises his hand: "Hunters?"

"Yes, exactly," Wolf says. "Hunters pay for almost all wildlife management we do in Montana, including the work to conserve grizzly bears."

Wolf next shows the kids pictures of biologists fitting radio collars on sedated grizzlies so the bears' movements can be tracked and analyzed. Then she shows them a video of a grizzly rubbing its back on a tree, from which researchers later gathered hair for DNA analysis. She talks about bear safety and how and when to use bear spray.

"Let's say you're on a trail, and you see a bear that's 100 yards away. What do you do?" she asks.

These fourth-graders know the answer. If you don't, you might want to consider visiting Montana WILD sometime soon.

Coming soon to a town near you

Starting this summer, FWP is sending an outdoor educator on the road to deliver Montana WILD programs to far-flung communities across Montana. The "Traveling WILD" education van will visit fishing events held by local conservation clubs and groups like Walleyes Unlimited and Trout Unlimited, as well as community fairs. At the events, a Montana WILD educator will conduct free fishing clinics for kids and adults. Afterward, Traveling WILD will hold additional outdoor education programs at the local library or community center before heading on to the next town. Funding for the vehicle and staff time comes from a $110,000 grant from the Montana Outdoors Legacy Foundation, which raises money to help fund FWP fish and wildlife conservation projects (mtoutdoorlegacy.org).

RAPT BY RAPTORS "Bringing people face to face with one of our ambassador raptors like this adult male kestrel keeps wildlife from being just an abstraction," says Lisa Rhodin, who coordinates the wildlife rehabilitation center next to Montana WILD. "Showing people raptors also puts a friendly face on FWP". Below: FWP intern Sarah Roberts hands out binoculars to each student and shows them how to focus on distant objects. "What we ultimately aim for here is more than just learning," says Thomas Baumeister, chief of the FWP Conservation Education Bureau. "We want to see an awakening among visitors, who then go home and feel excited and proud about their wild neighbors."

Great Gravel

New research shows how underground floodplains maintain healthy river "immune systems."

By Jim Robbins

They are beautiful, glistening icons of Montana, filled with life, history, and economic value. But there is far more to mountain rivers than the water churning between their banks

Authors of an important new study published earlier this year examined the essential role of gravel-bed rivers in western mountain ecosystems—the first time an interdisciplinary team has looked at river systems on such a large scale.

"A river doesn't just flow down the channel," says F. Richard Hauer, professor of stream ecology at the University of Montana and the paper's lead author. "It flows over and through the entire floodplain system, from valley wall to valley wall, and supports an extraordinary diversity of life."

Perhaps most surprising of all: "Most of the water in these systems is not in the river; it's in the gravel."

The life that depends on healthy mountain river systems is legion. The recent paper, published in the journal *Science Advances*, brought together researchers from Montana and Canada and from different disciplines, including bear, avian, and ungulate biologists. They were surprised to find that a large number of species rely heavily on the biodiversity generated by river ecosystems, not just fish and other aquatic animals. "These gravel-bed river systems are where the magic happens," Hauer says. "Two-thirds of species spend part of their lives in the floodplain." River floodplains are among the most ecologically important habitats on the continent, Hauer and his colleagues concluded, supporting a hidden wealth of biological activity.

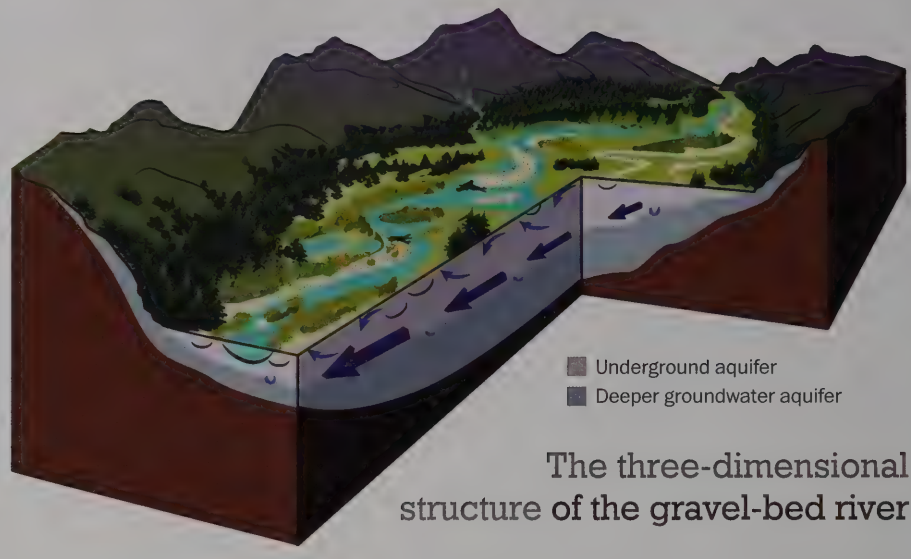
LEFT TO RIGHT: JOHN LAMBING; ED COYLE

MORE THAN MEETS THE EYE
Left: Most water in a river system is not in the channel but in underground gravel that stretches from valley wall to valley wall. Right: The gravel contains microbes that fuel entire river ecosystems.

What most people think of as a "river" is melting snow and groundwater flowing down a channel. But the vast majority of water in a river system is moving far more slowly through the labyrinth of underground cobble, gravel, and sand networks that make up the entire valley bottom, from the base of one mountain range to the other. This subterranean habitat is home to microbes and aquatic insects, such as stoneflies, which are critical to a river's food chain. Water flowing through the matrix of rock and sand filters out organic material and releases nitrogen, phosphorous, and other nutrients that well up through the entire system. These nutrients are then made available to plants and insects on the surface—a jolt of biological adrenaline. This in turn draws birds and beavers, elk and moose. The plant eaters then attract predators.

Before studies of river ecosystems began in the 1970s, scientists thought the "hyporheic" zone—the groundwater of the river system—lay within just a meter or so of the river bottom and banks. Now, after four decades of study, it's clear that the zone takes up most of the river valley.

"I'll never look at a river the same way again," says Michael Proctor, an independent grizzly bear biologist in British Columbia and one of the paper's authors. "It gives my argument to protect river valleys for grizzlies a powerful punch, because I am not just arguing for bears, but for a wide diversity of nature."



The three-dimensional structure of the gravel-bed river

In this cutaway view, the underground "hyporheic" aquifer, characterized by river water flowing through the gravel subsurface, is shown from valley wall to valley wall. The larger blue arrows signify the subsurface waters that develop at the upper end of the floodplain and flow through the underground gravel to discharge into the surface at the lower end of the floodplain as ponds and springs. The smaller arrows near the surface illustrate the water exchange between the surface waters and the upper hyporheic waters in the shallow bed sediments that occurs repeatedly along the length of the floodplain. The shallow U shapes illustrate the exchange that occurs between the hyporheic zone and deeper groundwaters that are stored for longer periods of time.

> "I'll never look at a river the same way again. It gives my argument to protect river valleys for grizzlies a powerful punch."

Choked to death

That diversity is under siege on several fronts. Human activities such as homebuilding, dam construction, irrigation, and channelization may be slowly choking highly dynamic river systems to death, the paper's authors conclude. Water in many Montana rivers has been diverted for irrigation, essential for agriculture. River courses have been altered by channelization for flood control and by the placement of boulder breakwaters, or riprap, which landowners install to prevent riverbank erosion. These human activities can slow and change a river's flow. Most significantly, they alter the complex interaction between the aboveground course of the river and the unseen currents that wind their way beneath the river valley's broad gravel and cobble bottom. Such human alterations to a river can impair its dynamism and resilience, especially in combination with rising temperatures from climate change and reduced water flows due to increased evaporation and irrigation.

The cumulative effect of human activities weakens a river's "immune systems," making aquatic organisms more vulnerable to stresses, such as the parasites that overwhelmed mountain whitefish on the Yellowstone in the summer of 2016.

In Montana, a dynamic river is important not just to fish and amphibians, but also to grizzly bears, wolves, and mountain lions descending from the mountains to the floodplain to find prey. Indeed, most of the species in a large river valley spend at least part of their lives in its floodplain.

Then there's the economic value of Montana's moving water. Each year, anglers spend $725 million to fish the state's rivers and streams, according to Montana Fish, Wildlife & Parks.

The new study demonstrates that altering this intricate biological machinery with dams and diversions has far-reaching effects, leading to long-term ecosystem decline. "A river is a huge, huge biodiversity engine with multiple parts," Hauer says. "If you keep taking out parts, pretty soon the engine stops."

River systems are complex. The aboveground river continually jumps channels and makes networks of new ones. Abandoned channels become covered with gravel and transform into important habitat for stoneflies and other insects that feed fish. Water flowing through the gravel beneath

Jim Robbins is a veteran journalist based in Helena, Montana. His latest book is The Wonder of Birds: What they Tell Us about the World, Ourselves and a Better Future. *Versions of this article originally appeared in* The New York Times *and* Yale E360, *the online magazine of the Yale School of Forestry & Environmental Studies.*

CLOCKWISE FROM UPPER LEFT: E. HARRINGTON. FH ILLUSTRATION; VIKTOR VRBOVSKY/VENGREETSON UNDERWATER PHOTOGRAPHY; LON E. LAUBER; DONALD M. JONES; TONY RYNIM

LIFE FLOWING FROM RIVER GRAVEL Scientists are now finding that the waters flowing beneath river floodplains support an enormous range of wildlife, fish, and other creatures. Clockwise from top left: a giant salmonfly consuming aquatic plants; a westslope cutthroat trout resting on a shallow river bottom; a white-tail doe grazing on river vegetation; grizzlies feeding on an elk carcass. Scientists say that nutrients in the floodplain fuel all this life and more.

the valley floor also surfaces in countless places along the floodplain, creating a constantly changing assortment of ponds, seeps, springs, and other important habitat.

Interaction between water in the river and groundwater is fundamental to the river ecosystem. During winter, cold water is stored in the rock and gravel, surfacing in summer to moderate warm temperatures. Pools of warmer water in winter and cool water in summer create refuges for fish and other species.

This mix of water plays a role in preventing disease, which is part of the story of last summer's parasite proliferation on the Yellowstone River. As water is withdrawn for irrigation, and structures such as riprap are installed, the mixing between groundwater and river water is reduced. That means less water is stored in gravel to cool the river in summer and warm the river in winter. The result? A wide range of problems, Hauer says. "[Fish] pool in warmer water and are stressed." Their metabolism increases in warmer water, "and they are not able to eat enough food and are not healthy. That makes them really vulnerable to disease." Warmer water may favor increased populations of parasites, while crowding in the cool water that remains may bring fish into contact with more parasites. That's the "perfect storm" of unfavorable conditions that state fisheries biologists say led to the whitefish die-off last summer.

> "A river is a huge, huge biodiversity engine with multiple parts. If you keep taking out parts, pretty soon the engine stops."

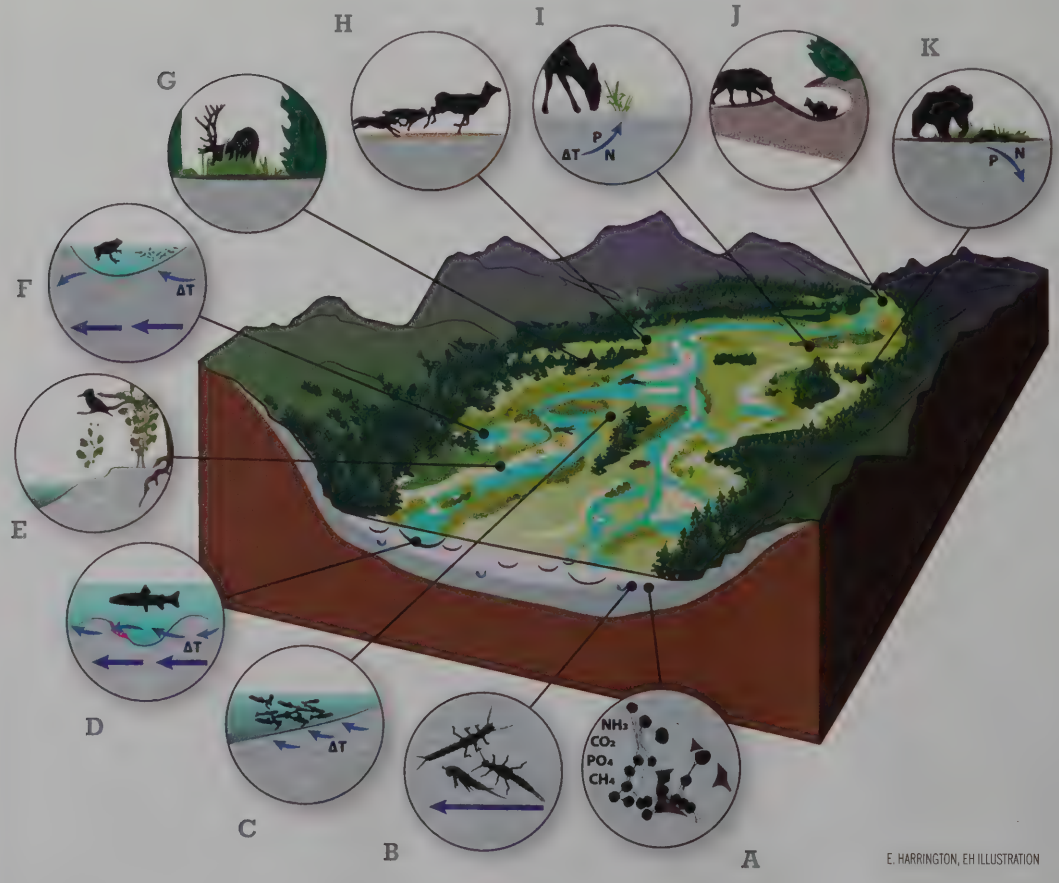
Meanwhile, invasive zebra and quagga mussels—a growing problem in the western United States that upsets the ecology of freshwater ecosystems—also favor warmer water. The degradation of river ecosystems may help them thrive, research shows.

All these harmful effects—combined with reduced water flows, longer summers, and warmer water and air temperatures—weaken the resilience of gravel-bed rivers, Hauer says.

From above

On a recent flight over the Bitterroot River south of Missoula, Hauer pointed out the floodplain. While the river below flowed down a main channel, it was easy to see from the air that, over centuries, the Bitterroot had frequently jumped its bounds to create a network of new channels.

The old channels were covered with gravel, an important habitat for aquatic insects that feed fish. Everywhere in the valley, water that flowed underground through the gravel had surfaced to create a



E. HARRINGTON, EH ILLUSTRATION

Cycles of life in a gravel-bed river floodplain

This illustration shows the complexity of floodplain habitat, the interactions among organisms, and the importance of gravel-bed river floodplains within mountain landscapes. (A) Microbes in the spaces between gravel particles process organic matter. (B) Crustaceans and insects inhabit the gravels of the floodplain. (C) Upwelling underground waters moderate the temperature of surface habitats. (D) Fish spawn in floodplain gravels. (E) Riparian birds prey on small fish. (F) Amphibians spawn in floodplain ponds and backwaters. (G) Ungulates consume floodplain vegetation. (H) Wolves prey on ungulates. (I) Vegetation emerges in early spring. (J) Wolves den along floodplain banks. (K) Carcasses left by grizzly bears and other carnivores decompose and enrich the soil with nitrogen and other nutrients.

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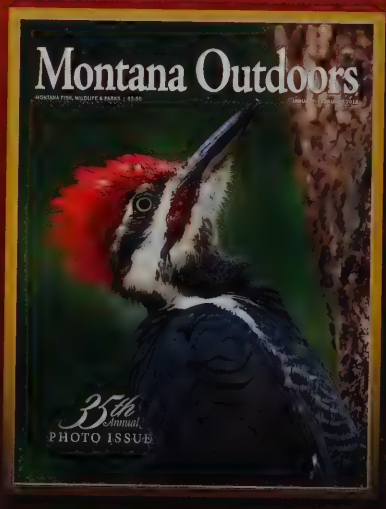

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THE NEED TO MEANDER Top: When spring floods reconfigure river channels, old channels become ponds for waterfowl and furbearers, or fill in with gravel that creates important habitat for aquatic insects that feed fish. Above: When landowners try to tame river movement with riprap, channels feeding underground habitats are sealed off. River movement stops, and with it the natural flow of nutrients and water throughout the floodplain.

diverse mix of springs and ponds.

Hauer also pointed out several places where people have sought to tame the river's unruly habits with levees and riprap in order to keep floodwaters off land so they can plant crops or build houses. "There's no renewal, the river can't move gravel around and create new mosaics of habitat," he said. "Nutrients are not dispersed. Everything gets locked in place and starts getting old and declines."

The environmental damage is hidden—at first. Channels feeding the underground habitats are sealed off as the river is confined. Then the populations of species that depend on the hidden flows, including trout and other fish, begin to falter.

The implications of this new research are enormous—and could make the conservation of rivers more difficult because it involves human activity on a much broader scale. Scientists say that if we continue to take bits and pieces out of these ecosystems, rivers such as the Bitterroot and Yellowstone will continue to decline, especially as the effects of warming temperatures mount. People don't like to hear that what they are doing is harming a river, Hauer says. But he maintains that society needs to know how its activities are altering the natural world if it hopes to fix ecological problems that affect outdoor recreation and tourism industries.

CLOCKWISE FROM LOWER LEFT: E. HARRINGTON, EH ILLUSTRATION; CRAIG & LIZ LARCOM; REBECCA STUMPF

Face to Face

What I learned from an angry grizzly bear

By Jessie Grossman

You'd think that on the summer solstice, the longest day of the year, I'd have had plenty of time to do everything I wanted to get done. But as usual, that was not the case. I'd planned to work and do chores, then take a walk starting in the early afternoon. But I tried to accomplish too much, and so it was not until late afternoon—though with five or six good hours of daylight remaining—that I began my hike.

I made my way along a sweet narrow tributary of the Yaak River, past beaver ponds with dragonflies and paddling ducks, through a forest of mature lodgepole pine. Here, on the same date the previous year, I'd seen grizzly tracks in the mud.

Walking up the trail, watching the lattice of shadows lengthen under the timber, I was trying my best to leave work behind so I could enjoy my hike.

It must have been my scattered thoughts that kept me from seeing the small bear in the tree until I stood beneath it. The subadult bear—no longer a cub, but not fully mature—was startled, hissing and squirming, struggling to stay on the limb around which it had wrapped its arms and legs.

It was a dark bear. At first I thought it might be a grizzly, and if its mother was nearby she might attack, concerned that I was endangering her young. But maybe it was a young black bear, whose mother would be more likely to just watch and wait for my departure. I took a few steps back and looked around for the mother, but saw nothing. As on most of my backcountry rambles, I had a canister of bear pepper spray holstered on my hip.

Not wanting to further stress the bear in the tree, and to move away from a potentially dangerous situation, I began to walk away.

Suddenly a large grizzly bear stood up from behind a rise, 30 yards away. While the young bear's identity had been ambiguous, there was no mistaking this mother grizzly—big round face and shoulder hump. We were already close when we saw each other. She didn't give the warning signs I had heard about—no jaw popping, gnashing, or huffing. She swayed her huge body from side to side.

It's cliché to say that time slowed way down when the bear dropped her front legs and charged, but that's what seemed to happen. The bear had a radio collar around her neck, put there by biologists who track the Yaak's small population using radio telemetry. It hung loose and swung like a necklace as she charged. Her fur had the blonde sheen of August-dry grass, and her skin seemed loose on her body, rippling with her movement. As her paws hit the ground, it sounded as though the forest floor was hollow. I saw her claws in an uncomfortable degree of detail, and they seemed extraordinarily long. When it became clear she wasn't about to turn away, I aimed at her and discharged a cloud of bear spray.

The grizzly turned and ran back up the hill toward where her cub, which had scooched down out of the tree, had raced into the timber. I assumed the encounter was over.

But then at the top of the rise she turned and charged again, though this time less threateningly. Her body language seemed to say, *I don't really want to do this, just leave me alone.* I was surprised at how calm I felt. I had not known it possible to experience deep calm and deep fear at the same time. I talked to the grizzly, quiet but assertive. "It's okay,

> I couldn't stop wondering about my encounter. What might have happened if I hadn't used the bear spray?

Jessie Grossman works for the Yaak Valley Forest Council in Yaak.

A CALM FEAR "It's okay, I don't want to hurt you," I said, as she continued toward me.

I don't want to hurt you," I said as she continued toward me. She then veered off and ran back uphill before I could discharge the bear spray a second time. I listened to the diminishing sound of her moving through the woods, deep into the drainage where I had originally planned to walk.

Then the woods were quiet. I walked back to the car, trembling.

In the following days, I obsessed over the bear, wanting to know as much as I could about her. I described my experience to Wayne Kasworm, the local U.S Fish & Wildlife Service grizzly biologist. He knew which grizzly I had encountered and told me about her lineage in the Yaak and reputation for being bold and curious.

As with all grizzlies that have been trapped and collared, this one had an identification number. Biologists use the number as they track bears to learn how they behave, where they den, if they're reproducing, where they travel, and if they're still alive. Kasworm said this bear had offspring that lived nearby. When I called him a few days later, after he had flown over the Yaak in an airplane to track the Yaak grizzlies' radio collar data points, he said she had crossed a road and run far away, into another drainage.

I couldn't stop wondering about my encounter. What might have happened if I hadn't used the bear spray? I like to think her charge would have been a bluff, that she still would have turned away at the last minute. But the truth is, I don't know what decision she would have made.

What I do know, from Kasworm and Montana Fish, Wildlife & Parks bear experts, is that if she had attacked, I likely would have survived. Lethal attacks are rare.

As for what happens to an aggressive bear, that depends. It might learn that confronting a human has, at first, no consequences and attack someone else. But bears that repeatedly attack people and cause injury are eventually trapped and killed.

If I'd been carrying a firearm, I might have wounded the grizzly, making her even more enraged and dangerous. Or I might have killed her, perhaps unnecessarily. There's no knowing the bear's intentions, only statistically what usually does and doesn't happen with bear encounters.

A friend later said that if you don't want to kill a bear, you need to go into grizzly country *prepared* not to kill one. If you bring a gun rather than bear spray, the result could be either a dead bear or a wounded and enraged one, with potentially lethal consequences for you.

Alternatively, if you go into grizzly country without bear spray and are attacked and injured, biologists might have to capture and kill the bear. Bottom line: Carrying bear spray doesn't just protect you. It protects grizzlies, too.

I've been guilty of not always remembering bear spray when I go into the woods. No longer. It weighs next to nothing. And, as I learned, it works.

The Yaak is home to only 20 grizzlies. The death of even one would greatly affect the population. Who would want to be responsible for that?

Now when I see bear prints, scat, or fur snagged on tree trunks, I am reminded that western Montana is home to real grizzlies, each one singularly important. It's our responsibility—our privilege, really, considering how few people in this world actually experience grizzly country—to honor these bears. That means protecting and preparing ourselves when we enter the lands we share with them.

Expert advice on hiking in grizzly country.

FWP offers tips and instructional videos on staying safe while hiking, hunting, and camping in bear habitat—which now is most of western Montana. Visit the FWP website at fwp.mt.gov and search for "Be Bear Aware."

PHOTO ILLUSTRATION BY LUKE DURAN, *MONTANA OUTDOORS*; GRIZZLY TRACKS: NATIONAL PARK SERVICE

That First Gun

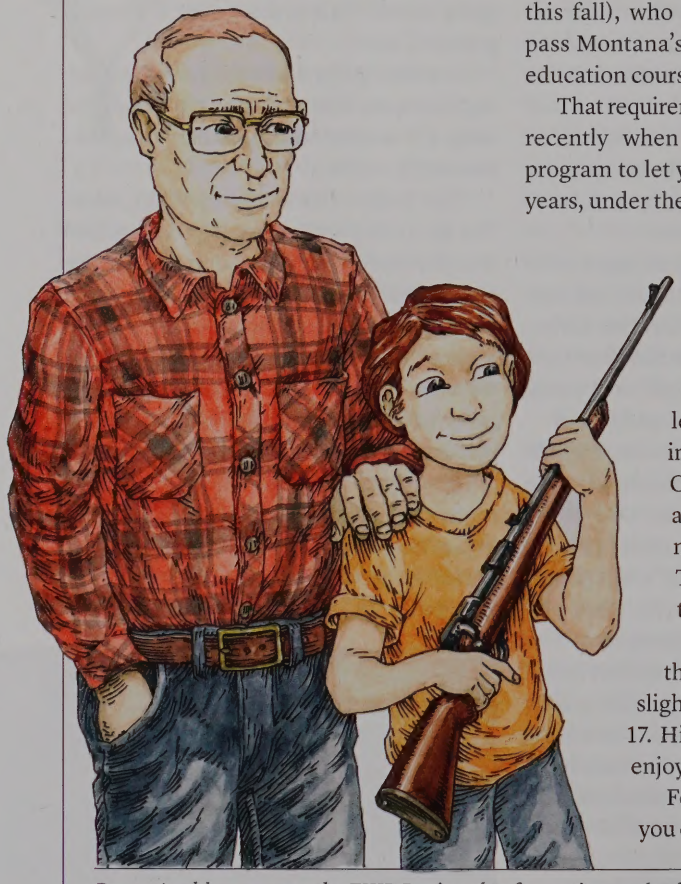
by Bruce Auchly

Just the other week, I gave my granddaughter and grandson their first firearms, a .22 rifle and a .410 shotgun.

It's a rite of passage familiar to most of us who hunt. We were either given our first firearm or saved money to buy it.

Presenting a young person with their first gun is more than just giving a gift. It's about passing along the hunting tradition, something that needs to start early.

Study after study indicates that if people don't start hunting before the teenage years end, the odds are against them being a hunter as an adult.



Unfortunately, parents in a growing number of families don't hunt. Fortunately, plenty of young hunters can learn from a neighbor, relative, or family friend. That's why it's so important for us hunters to help any young person who shows an interest in hunting. That starts with helping provide a good education.

For decades Montana law required everyone ages 12 to 17 to complete a Montana Fish, Wildlife & Parks hunter education course before being allowed to hunt. That law changed a few years back to cover older beginners. Now, anyone born after January 1, 1985 (that's age 32 and younger this fall), who wants to hunt here must pass Montana's or another state's hunter education course.

That requirement was further amended recently when the state established a program to let young people hunt for two years, under the supervision of a parent or guardian, before taking hunter education.

Back in the Dark Ages (pre-Internet), the hunter safety program meant sitting in a room, learning from a volunteer instructor, and taking a test. Oh yes, it often included a gruesome 16-millimeter movie on gunshot wounds. Then, as now, the instruction was top-notch.

The format, though not the quality, has changed slightly for those younger than 17. Hint: The movies are more enjoyable.

For those age 18 or older, you can take the hunter education course over the Internet. Ah, the Age of Enlightenment. It's the same high level of instruction as before, only more convenient for those with busy schedules.

As has always been the case, hunter education is only the beginning. A young hunter still needs someone to provide a gun, transportation to hunting areas, and instruction in additional outdoor skills. There is only so much a person can learn from a book or computer screen.

Urbanization and fragmentation of the modern family have thrown up obstacles between young people and hunting opportunities. So has the deluge of competing diversions, from soccer to computer games.

Members of state and local conservation groups have stepped up to help take kids hunting. So have family members and neighbors. I remember my dad taking me and a buddy. My friend, whose family had no hunting connection, went that one time. Afterward, he decided he'd rather fish.

That's okay, too, as long as youngsters have the option to make a choice. It's sad to think of a boy or girl who might have loved hunting never even having the opportunity to try it.

If there's a kid in your neighborhood who shows an interest in hunting, consider taking that young person afield some day this fall. Pry open your wallet and, after the moths have flown out, buy that youngster a good starter rifle or shotgun.

Who knows where that initial firearm will lead them.

My first rifle? It was a bolt-action .22 my parents gave me for Christmas. It poured rain that day, so I couldn't take it outside and shoot it.

Worst day of my life.

That was the same .22 rifle I gave my grandkids.

Best day of my life.

Bruce Auchly manages the FWP Regional Information and Education Program in Great Falls. Ed Jenne is a Missoula illustrator.

ILLUSTRATION BY E.R. JENNE

Common nighthawk

Chordeiles minor By Rob Roberts

Last summer while hiking on Missoula's Waterworks Hill, watching a storm approach, I was nearly knocked over by a thunderclap and "whoosh" by my head. When it happened again, I looked skyward and saw a common nighthawk deftly navigating the gusting wind and making it clear that it wanted no part of me on that weather-beaten patch of stunted lupine.

I later discovered two fuzzy, motionless young in the same spot—only alerted to their presence when their mother flushed from nearly under my feet and went flapping and hopping down the hillside. Thereafter watching from afar, I became transfixed by these spirited masters of air, camouflage, and deceit.

Identification

The common nighthawk is a dark, medium-size bird with a short bill and long, pointed wings, resembling a boomerang with a head. Neither a hawk nor strictly nocturnal, it is often seen at dawn and dusk making agile and erratic flight patterns with loops and dives as it hunts for winged insects. Its large, gaping mouth allows the nighthawk to efficiently scoop up prey, much like an avian version of a whale shark grazing the ocean for krill. Nighthawk relatives in Montana include the common poorwill and eastern whip-poor-will. The common nighthawk is differentiated by its white throat patch and white bars near the end of its wings, as well as the male's distinct, nasally "*peent*" call while in flight.

Distribution, Migration, and Habitat

The common nighthawk is found throughout the continental United States and across Montana. These birds make one of the longest migrations of any North American bird, up to 4,000 miles, and are one of the last to arrive in spring in the lower 48 states. Individuals reach Montana from wintering grounds in southern South America by early to mid-June. They prefer open areas like grasslands or forest clearings, but will take up residence in farm fields, beaches, rock outcrops, or anywhere they can find abundant insects and a water source.

Writer Rob Roberts lives in Missoula.

TOP TO BOTTOM: KATE DAVIS; FRANCIS C. BERGQUIST

Scientific name

The genus name ***Chordeiles***—from the ancient Greek *khoreia*, a type of dance with music, and *deile*, "evening"—refers to the nighthawk's graceful twilight flight. The specific ***minor*** is Latin for "smaller." An interesting side note: *Chordeiles* is a genus in the family *Caprimulgidae*, which includes more than 80 species of birds worldwide, commonly called nightjars, bullbats, or goatsuckers. *Caprimulgidae* is derived from the Latin *caper* or "goat" and *mulgeo* or "extract milk," from an ancient superstition that nightjars raid farmsteads under cover of darkness and suckle nanny goats.

Camouflage

Nighthawks have cryptic plumage, which makes them nearly invisible in trees or on the ground during daylight. Splotches or bars of gray, brown, and white over a black base help the birds disappear into a background of leaves, bark, and grass. They often sit parallel to a branch, rather than across it like most birds, looking much like a branch stump or leaf cluster.

Distraction display

The nighthawk is a ground nester, laying two pale olive and brown speckled eggs in an open patch of dirt, gravel, or rock. The female occasionally leaves her eggs to feed. She also leaves the nest when a passerby gets too close. Much like a killdeer, she tries to confuse potential predators by flapping her wings and acting lame while leading the intruder away from the nest, behavior known as a distraction display. To avoid revealing the nest location, she will return only when the threat has been lured far away.

Kaboom

With a sharp nosedive, the male nighthawk will swoop down toward a predator and flare at the last second, producing a sharp "boom" or growl as the wind rushes over its wings and vibrates the primary feathers. The male employs these same aerial acrobatics to dive-bomb females during courtship displays, in what seems like a contrary way to woo a prospective mate.

Conservation

Common nighthawks are widespread and abundant in Montana. In much of the rest of the United States, however, populations are declining. Biologists say declines are likely due to widespread pesticide use to control mosquitoes, and reductions in nesting areas on gravel-topped roofs replaced by rubber liners or asphalt shingles. The loss of open areas and clearings due to urban development, reforestation, and fire suppression may have led to additional habitat loss, avian scientists say.

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PARTING SHOT

TO THE OTHER SIDE As a bull looks on, a cow elk crosses the Flathead River. See page 32 to learn what scientists are discovering about river valleys like this one and how underground water systems affect life forms ranging from microbes to ungulates. Photo by Dee Linnell Blank.

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